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S[TOCKS] (J. B.). **Weevil Damage in Nursery.**—*Quart. J. For.* **32** no. 3 pp. 201–202, 1 fig. Twickenham, July 1938.

During dry weather from mid-April to mid-May 1938, adults of *Barypithes pellucidus*, Boh., caused considerable damage in a forest nursery in Devon. The weevils were first observed attacking the bark near ground level of small Weymouth pines [*Pinus strobus*] that were already showing fructifications of the rust fungus, *Cronartium ribicola*. They were then found to be present in considerable numbers in the soil throughout two neighbouring beds of seedlings of European larch [*Larix decidua*] and Sitka spruce [*Picea sitchensis*], many of which were dying off as a result of injury to the bark. They were successfully trapped by placing billets, about 9 ins. long and 2 ins. in diameter, at intervals of about 3 ft. from each other. These were examined daily, and the weevils collected and destroyed.

Forest Bibliography to 31st December 1933. Part III. C. Forest Protection.—Cr. 4to., pp. 201–274. Univ. Oxford, Dep. For., 1938. Price 12*s.* 6*d.*

In section 2 (pp. 203–219) of this third part of a bibliography of forestry literature up to 1933, the references of entomological interest relate chiefly to the protection of insectivorous birds.

MICHELBACHER (A. E.). **The Biology of the Garden Centipede, *Scutigerella immaculata*.**—*Hilgardia* **11** no. 3 pp. 55–148, 29 figs., 13 pp. refs. Berkeley, Calif., January 1938.

The following is largely taken from the author's summary of this paper, which includes descriptions of all stages of *Scutigerella immaculata*, Newp., and details of a study of its biology under laboratory, field and greenhouse conditions in California: This Scutigerellid is widely distributed in the Northern Hemisphere, but south of the equator it has only been recorded from Buenos Aires. Other species of Symphyla occur throughout the world; the northern limit of distribution appears to be an expected minimum temperature of about −15°F. A type of storage culture was developed in which it reproduced readily, giving a continuous supply of individuals for experimental study. Oviposition, which takes place shortly before moulting, first began between the 7th and 8th moults, suggesting that sexual maturity is then reached, but in most cases eggs were not obtained until much later. Moulting occurs throughout life, and since an individual may live 4 years or more, the maximum number of moults probably exceeds 50. The moulting characteristics of different individuals vary greatly; a sex factor is present, and a genetic factor is possibly involved. Other factors that influence moulting are food, temperature, humidity and mutilation. Moulting is most frequent at 28°C. [82·4°F.]. A temperature of 37°C. [98·6°F.] is lethal. Individuals can survive 2°C. [35·6°F.] for long periods. At 0°C. [32°F.], they do not live long if they have previously been kept at room temperature, but can survive for many months if they have been first exposed to 4·5°C. [40·1°F.]. The optimum temperature is somewhere between 12 and 20°C. [53·6 and 68°F.].

S. immaculata appears to be a vegetable feeder and to prefer succulent materials, although it feeds on many kinds of lower plant life. It occurs from the soil surface to a depth of 4 feet. Moisture seems to

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be the most important factor influencing its vertical distribution, which is also affected by temperature, soil texture, soil structure, and vegetation. Its population may reach a maximum of 22 and 90 millions per acre in the field and in greenhouses, respectively. In certain areas, it is a serious pest of cultivated crops. The most satisfactory methods of control are flooding, under field conditions [*cf.* **26** 280], and the use of raised benches, steam treatment, or soil fumigation [**21** 588], in greenhouses. True centipedes (Chilopoda) are among the most important natural enemies.

WATERSTON (J. M.). **Report of the Plant Pathologist, 1937.**—*Rep. Dep. Agric. Bermuda* 1937 pp. 24–37. Hamilton, 1938.

The information contained in this report on pests of *Juniperus bermudiana* in Bermuda has already been noticed [*R.A.E.*, A **26** 220, etc.]. Counts of larvae of *Thrips tabaci*, Lind., made at intervals of 5 days from 3rd April to 3rd May 1937, on 5 varieties on onion showed that the population rose steadily during April, reaching a peak between the fourth and fifth counts. An exceptional fall in numbers on one variety after the first count was found to be correlated with poor growth. There was a steady decrease in the population during May, probably caused by a number of factors including a heavy rainfall on 9th May, a rise in temperature and an increase in the numbers of larvae of the predacious Syrphid, *Mesogramma marginata*, Say. Immersing seedlings before planting in a weak solution of Clensel and nicotine sulphate gave temporary control. Other pests that occurred during the year included *Hercinothrips* (*Heliothrips*) *femoralis*, Reut., on fruit on neglected banana plants to which they had migrated from morning glory (*Ipomoea cathartica*), *Ceratitis capitata*, Wied., in sweet orange fruits, *Empoasca fabae*, Harr., on watermelon, *Taeniothrips simplex*, Morison (*gladioli*, Mlt. & Stnw.) on *Gladiolus*, and *Chrysomphalus agavis*, Ths. & Ckll., on a prostrate form of the Chinese Juniper (*Juniperus chinensis*). Larvae of the Syrphid, *Allograpta obliqua*, Say, were found preying in large numbers on *Aphis gossypii*, Glov., the vector of the rosette or yellow flat disease of lilies. The use of adhesive bands on various trees and shrubs effectively checked the spreading by *Pheidole megacephala*, F., of Coccids and Aphids.

WILLE (J.) & LAMAS (C. J. M.). **El "gusano de la hoja" del algodonero** *Anomis texana* **Riley. Una de las más graves plagas del algodón en el Perú.** [The Leaf Caterpillar of Cotton, *A. luridula*, Gn. One of the most serious Pests of Cotton in Peru.]—*Bol. Estac. exp. agric. Minist. Fom. Peru* no. 12, 71 pp., 13 pls. Lima, December 1937.

The authors present in this paper the results of six years' field and laboratory investigations in Peru on *Anomis luridula*, Gn. (*texana*, Riley), which is one of the chief pests of cotton in the coastal regions [*cf. R.A.E.*, A **25** 112] and destroyed 90 per cent. of the crop in one district in 1931. An account is given of the classification and morphology of all stages of this Noctuid ; and the average durations of each stage and of the 6 larval instars in each season of the year and over the whole year are tabulated. Another table gives the minima in summer and the maxima in winter. The average durations of the egg, larval and pupal stages and the pre-oviposition period in the laboratory were 3, 15·1, 9·5 and 2·7 days, respectively, in summer, and 8·2, 31·7, 21

and 5·3 days in winter. As no real hibernation occurs, this permits 6–8 generations a year, which was confirmed in the field, but the population in January–March is 100 times that in July–October.

The males, which were practically as numerous as the females, emerged from 1 to 6 days later than the latter. Oviposition occurred 2–7 days after emergence, and females deposited an average of 906 eggs singly and generally on the lower surface of the leaves. Most of the eggs were laid at the beginning of the oviposition period, which lasted 6–15 days, and those deposited after about the second day were not viable, although pairing had been normal. In the first two instars the larvae fed on the lower leaf-surface, leaving the upper epidermis untouched, but in the four later ones they perforate the leaves. In nature the larvae were also observed feeding on wild cotton (*Gossypium raimondi*). Pupation occurred at or just below the surface of the soil. The best conditions for normal development in summer and winter were 22 and 16°C. [71·6 and 60·8°F.] and 80 and 90 per cent. relative humidity, respectively, conditions that commonly occur in valleys in central Peru. An outbreak in 1930–31 followed warm, dry weather, but was ultimately checked by the Tachinid, *Eucelatoria australis*, Tns. [**22** 474, etc.]. Morning mists cause the larvae to continue feeding actively, and still further injury is caused by a set-back in the growth of the cotton plants owing to the sunless weather. All varieties of cultivated cotton are equally attractive to *A. luridula*.

The natural enemies observed, notes on which are given, included *Trichogramma minutum*, Riley, which parasitises the eggs, *Eucelatoria australis* and species of *Rhogas*, *Meteorus* and *Eupelmus*, which parasitise the larvae, and various predators, of which the Cicindelid, *Megacephala carolina*, L. (*Tetracha chilensis*, Cast.), was of some importance. The percentage parasitism by *E. australis*, which in September 1930 was 4·6, rose monthly to 97·8 in March 1931, and fell to 48·6 in May. The high rate of parasitism in March, which rendered artificial control of the pest unnecessary, was due to the warmth and dryness of the preceding winter and the absence of morning mists in the period January–March [*cf.* **25** 112]. Larvae of *E. australis* that were already 5 days old left host larvae that were dying as a result of dusting with arsenicals, and pupated normally, giving rise to undersized adults. Parasitism by *Rhogas* sp. averaged about 10–20 per cent., though in one instance 80 per cent. was recorded.

Various measures for control are discussed, but dusting with calcium arsenate has supplanted all others. A dust containing 40 per cent. arsenic pentoxide is satisfactory at the rate of about 4½–6 lb. per acre, though 2 or 3 applications are needed for serious infestations. Aeroplanes have been used with success for applying the dust since 1926.

AUTUORI (M.). **Notas sobre a introducção e multiplicação do parasita *Tetrastichus giffardii* Silvestri no Brasil.** [Notes on the Introduction into and Multiplication in Brazil of the Parasite, *T. giffardi*.]—*O Biologico* **4** pt. 4 pp. 128–129. S. Paulo, April 1938.

In August 1937, a consignment of *Tetrastichus giffardi*, Silv., was imported into Brazil from Hawaii for the control of fruit-flies. Of

the 12 adults obtained from it, 8 were confined with fruit containing larvae of *Anastrepha*, but no progeny was obtained. The other 4 were confined with coffee berries infested by larvae of *Ceratitis capitata*, Wied., which they successfully parasitised. Seven successive generations had been reared on this host by March–April 1938, and the seventh generation numbered 4,814 individuals.

RAMCHANDRA RAO (R. B. Y.). **A Report on the Work done by the Research Staff under the Locust Research Entomologist to the Imperial Council of Agricultural Research at Karachi during the Year 1937.**—ii+62 pp. New Delhi, 1938.

Field studies and survey work on *Schistocerca gregaria*, Forsk., phase *solitaria* were continued in 1937 in British Baluchistan and the Sind-Rajputana desert [*cf. R.A.E.*, A **25** 390]. The distribution and breeding of the locust in winter and summer rainfall areas are discussed and correlated with meteorological data. Breeding did not occur in the Mekran " reks " [*cf.* **22** 121], owing to failure of rains, but was extensive in spring on flooded areas and cultivated fields in the interior of Baluchistan and in Kachhi, where rainfall was normal. The locusts of the second generation produced in the autumn of 1936 in Bikaner and Jaisalmer overwintered and bred there in February. By March, however, they had migrated, apparently into the Baluchistan uplands and Kachhi, where breeding continued between March and November. The generation produced there migrated eastwards into the Indian desert, where there was heavy breeding during the monsoon rains in June–July. Another generation was produced in the desert in October and November, as the result of September rains. Between September and November there was a migration to the coastal part of Mekran of the locusts bred in the Indian desert.

Experimental work on *Schistocerca*, on the lines described in previous reports [**24** 443; **25** 390], was continued. Both at Pasni, where drought prevailed, and at Ambagh, where conditions were favourable for breeding, only three generations a year were produced under semi-natural conditions. Studies were made of the effect of food on development and sexual maturation and of the food-preferences of the hoppers. Sexual maturation and larval development were most rapid on diets of cabbage, *Indigofera cordifolia* and *Tribulus terrestris*. In the food-preference experiments, *Heliotropium undulatum* was used as a standard, and the numbers of hoppers feeding on different plants in each single experiment were expressed as a percentage of the numbers feeding on it. The figures for some fifty different plants are given in a table; wheat and *Pennisetium typhoideum* were particularly attractive.

Investigations on the effect of sunlight on adult coloration and a biometrical study of material collected during the year were continued. Examples of pure phase *gregaria* from swarms almost invariably had antennae with 26 segments and 6 eye-stripes [*cf.* **24** 634]; in phase *solitaria*, the forms with 6 or 7 eye-stripes almost invariably had 28 or 29 antennal segments.

Locusta migratoria, L., phase *solitaria* was more active than usual in Baluchistan and Rajputana, actually doing damage to cereals and sugar-cane in the latter area. Spring breeding was observed in north-eastern Baluchistan. In Rajputana, July rainfall was followed by a drought lasting till the heavy rains of September. The large *Locusta*

population was apparently carried by storms into south-eastern and central Rajputana, where adults concentrated for egg-laying in fields of cereals. The following generation, which included individuals with phase *gregaria* characters, became adult in November and apparently migrated westwards into Lasbela.

There is some evidence that *Patanga succincta*, L., also breeds in areas of high monsoon rainfall and migrates into the desert in the autumn.

The natural enemies of locusts observed included a number of birds, which are enumerated; bats, which ate adults of *Locusta*, and a Tyroglyphid mite found infesting *Schistocerca* in several localities.

Tabulated records of locusts observed during the surveys, meteorological data, and the tabulated results of experimental work are appended.

FULLER (M. E.). **Some Flies associated with Grasshoppers.**—*J. Coun. sci. industr. Res. Aust.* **11** no. 2 pp. 202–203. Melbourne, May 1938.

Brief notes are given on three species of Diptera reared from grasshoppers in Australia.

The Nemestrinid, *Trichopsidea oestracea*, Westw., parasitised various grasshoppers, including *Chortoicetes terminifera*, Wlk. [*R.A.E.*, A **24** 807], and is widely distributed in eastern Australia. The parasitism percentage varied, but was about 5 for all species in the south-west of New South Wales. A single larva occurred in the abdomen of each parasitised hopper, and, when fully fed, emerged from its still living host to enter the ground and remain there in the prepupal stage for several months. The pupal stage, which lasted about 3 weeks, occurred during the following summer. Larvae of the Bombyliid, *Cyrtomorpha flaviscutellaris*, Roberts, which are predatory rather than parasitic, were discovered feeding on eggs of *Austroicetes cruciata*, Sauss., in the west of Western Australia; the prepupal stage, which in the laboratory lasted several months, and sometimes over a year, was passed among the empty pods. The pupal stage lasted 3 weeks.

Field and laboratory experiments proved that *Helicobia australis*, Johnst. & Tiegs, is not parasitic [*cf.* **25** 633], but deposits its larvae on dead hoppers. The life-cycle averaged 30 days.

CHOPARD (L.). **La biologie des Orthoptères.**—*Ency. ent.* (A) **20** [4] +541 pp., 4 pls., frontis., 453 figs. Paris, P. Lechevalier, 1938. Price *Fr.* 250.

This book comprises a detailed summary of information on the bionomics of Orthoptera (including Dermaptera). The subjects dealt with in the successive chapters are: geographical distribution; various habitats; nest-building; reproduction; development; activity; sound-production; autotomy and regeneration; reflexes and means of defense; reactions to external factors; protective colouration and mimicry; variation and heredity; gregariousness and family associations. Each chapter contains a list of references, and a list of other animals with which Orthoptera live as parasites or commensals is appended. The book is profusely illustrated, mostly by original figures, and is a useful source of up-to-date information on the group.

LADELL (W. R. S.). **Field Experiments on the Control of Wireworms. With Appendix. The Information supplied by the Sampling Results by W. G. Cochran.**—*Ann. appl. Biol.* **25** no. 2 pp. 341–389, 7 figs., 29 refs. London, May 1938.

This paper presents the results of three tests of soil fumigants against wireworms in England. They were carried out with a special field plot technique and were designed to show the adequacy of replication required for such types of investigation rather than the value of any particular fumigant. The plots were laid out on old grassland with a heavy clay-with-flints soil, and their arrangements and sizes were as follows: 5×5 Latin square, $\frac{1}{60}$ acre; 3×10 randomised blocks, $\frac{1}{70}$ acre; and 6×8 randomised blocks, $\frac{1}{200}$ acre. Wireworm populations were ascertained in every case by sampling the soil before and after treatment. The Ladell flotation machine [*R.A.E.*, A **25** 109] was found rather too small, and a modification of the technique, using oil drums, was adopted. Later, a larger and improved form of the machine was used. In the first experiment, 6 samples (9×9×5 ins.) were taken in each plot, making a total of 150 soil samples on each occasion. In the second, 4 samples per plot were taken, making a total of 120, but their size was 9×9×5 ins. before treatment and 6×6×5 ins. after it. In the third experiment, 2 samples (6×6×6 ins.) were taken per plot on each occasion.

Where baits of cabbage leaf and potato were used as a means of estimating the wireworm population, no relationship was found between the number obtained in the baits and the actual number in the soil. None was found between the density of the population and the pH of the soil. The mean densities of the original population were 65, 335 and 277 per sq. yard, respectively, in the 3 experiments. The untreated controls showed changes of −23, +1·2 and −8·7 per cent. between the first and second sampling, respectively. The difference was largest when the second sampling was done in July, and smallest when the second sampling was done in May. It is suggested that the big drop in July might be due to a downward movement of the wireworms to escape the heat [*cf.* **24** 12], but the evidence is insufficient to prove this. The uneven distribution of the wireworms in the soil resulted in high sampling errors, accounting for most of the experimental error. This aspect of the work is fully discussed in the appendix.

The wireworms were grouped according to size in order to ascertain if there was any differential action of the fumigants on the different instars; no conclusive evidence was obtained. The fumigants were all scattered along the bottom of a plough furrow, so that they were covered by the next furrow slice. The weights given in brackets are the rates per acre at which they were applied. In the first experiment, the percentage reductions of the wireworm population were 69 with a mixture of orthodichlorobenzene and paradichlorobenzene (560 lb.), 45 with a mixture of sodium cyanide and anhydrous magnesium sulphate (840 lb.), 45 with chloropicrin (224 lb.), and 15 with chlorodinitrobenzene (224 lb.), as compared with a reduction of 23 in the controls. The chloropicrin was adsorbed on kieselguhr. In the second experiment, the percentage reductions were 62·2 with a mixture of orthodichlorobenzene and paradichlorobenzene (800 lb.), and 33·2 with chloropicrin (245 lb.), as compared with an increase of 1·2 in the controls. The proportion of orthodichlorobenzene in the mixture was higher than

in the first experiment, and pellets containing 25 per cent. chloropicrin were used. In the third experiment, on a summer fallow, the percentage reductions were 59·8 with crude naphthalene (1,120 lb.), 28·6 with tar (33 per cent.) and lime (5,712 lb.), and 20·4 with ammonium carbonate (70 lb., equivalent in nitrogen content to the tar), as compared with a reduction of 8·7 in the controls. With superphosphate (672 lb.) and lime (3,808 lb.) there were percentage increases of 8·6 and 17, respectively. The orthodichlorobenzene and paradichlorobenzene had, in both cases, an adverse effect on sugar-beet, owing to the short interval between the application and the drilling of the seed ; there was also a residual effect the next year, a reduction in the number of wireworms and an increase in the plant-stand (barley), although there was no significant difference in the final crop yield. Chloropicrin did not harm sugar-beet or barley. The mixture of sodium cyanide and anhydrous magnesium sulphate increased the yield of sugar-beet ; the residual effect was negligible.

Hopf (H. S.). **Investigations into the Nutrition of the Ash-Bark Beetle, *Hylesinus fraxini* Panz.**—*Ann. appl. Biol.* **25** no. 2 pp. 390–405, 33 refs. London, May 1938.

From investigations into the enzymes of the alimentary canal of adults and larvae of *Hylesinus fraxini*, Panz., and a comparative analysis of ash bark and the frass of the larvae [*cf. R.A.E.*, A **25** 283], it is concluded that the food of this Scolytid consists of proteins derived directly from the bark, and of carbohydrates derived from a variety of bark constituents. The absence of starch in the bark attacked implies that the infested trees are already in a pathological condition and that the beetle is only a secondary pest [**14** 583]. It might appear, therefore, that the beetles are attracted to trees that offer them, in the form of already broken-down starch, a more easily digestible food. The question remains open whether the starch break-down as such, through fermentation or otherwise, supplies the attractant to the beetle.

Tattersfield (F.) & Martin (J. T.). **The Problem of the Evaluation of Rotenone-containing Plants. IV. The Toxicity to *Aphis rumicis* of certain Products isolated from Derris Root. With an Appendix by W. G. Cochran.**—*Ann. appl. Biol.* **25** no. 2 pp. 411–429, 2 figs., 8 refs. London, May 1938.

The following is largely taken from the authors' summary and conclusions : Previous papers in this series [*R.A.E.*, A **25** 110, 111] have indicated a difference in the chemical constitution of the resins extracted from roots of *Derris elliptica* and *D. malaccensis*. In this paper it is shown that a crystalline derivative that gives rise to toxicarol on treatment with alcoholic potash, and which may be regarded as its precursor [*cf.* **26** 616], is largely responsible for the chemical and physical properties that differentiate the Sumatra-type and *D. malaccensis* resins from those of *D. elliptica*. An account is given of the preparation and a few of the properties of this compound, isolated from the extracts of Sumatra-type derris root. Although containing extraneous material, probably sumatrol, in the present investigation, it gives a high yield of optically inactive toxicarol, is characterised by the switch-over from laevo- to dextro-rotation on the addition of

caustic potash in ethyl alcohol to its benzene solution, and is mainly responsible for this feature of the Sumatra-type resins under similar treatment. The change-over in rotation was followed by a gradual fall in rotation of a unimolecular type. The compound is laevo-rotatory in benzene and dextro-rotatory in alcohol.

Details are given of tests of the toxicities to *Aphis rumicis*, L., of this compound, sumatrol, rotenone, and derris resins freed from rotenone so far as possible without the addition of the latter compound to aid its own separation. Rotenone (used as a standard) was about 13–15 times as toxic as either the toxicarol precursor or sumatrol and 4 and 6 times as toxic as the resins of the Sumatra-type root and *D. elliptica*, respectively.

The statistical method used in analysing the insecticidal data is described in the appendix.

CARTWRIGHT (K. St. G.). **A further Note on Fungus Association in the Siricidae.**—*Ann. appl. Biol.* **25** no. 2 pp. 430–432, 3 refs. London, May 1938.

The following is almost entirely taken from the author's summary : A fungus has been isolated from glands, eggs and oviposition and larval tunnels of both *Sirex cyaneus*, F., and *S. gigas*, L., from several different localities in England [*cf. R.A.E.*, A **22** 87]. The culture of the fungus from *S. cyaneus* closely resembles, but is not identical with, that of *Stereum sanguinolentum* ; it is therefore thought that it is a form of this species. The fungus isolated from *Sirex gigas* has been identified as *S. sanguinolentum*. At the moisture content favourable for the development of the larva, only slow development of the fungus can take place. At a higher humidity, vigorous fungus growth ensues, with apparently fatal results to the larva. The fungus is introduced into the wood during oviposition in the case of both *S. cyaneus* and *S. gigas*. Fungus was found to be present in glands at the base of the ovipositor in late-stage female pupae.

A fungus of which the culture resembles in appearance that of *Daldinia concentrica* has been isolated from larval tunnels and from glands in adult females of *Xiphydria prolongata*, Geoffr.

EVANS (A. C.). **Physiological Relationships between Insects and their Host Plants. I. The Effect of the chemical Composition of the Plant on Reproduction and Production of winged Forms in *Brevicoryne brassicae* L. (Aphididae).**—*Ann. appl. Biol.* **25** no. 3 pp. 558–572, 4 figs., 17 refs. London, August 1938.

The following is the author's summary of the results of experiments carried out in Hertfordshire with insects feeding on cabbage : It is shown that under late summer conditions of light, the rate of reproduction of the Aphid, *Brevicoryne brassicae*, L., is positively correlated with the nitrogen content of the food-plant, and, in particular, with the protein content. The formation of winged forms is negatively correlated with the same factors.

The chemical composition of the plant affects the rate of growth, length of larval period and final pupal weights of *Pieris brassicae*, L. It also influences the amount of food eaten.

Busvine (J. R.). **The Toxicity of Ethylene Oxide to** *Calandra oryzae*, *C. granaria*, *Tribolium castaneum*, **and** *Cimex lectularius*.—*Ann. appl. Biol.* **25** no. 3 pp. 605–632, 11 figs., 60 refs. London, August 1938.

The author's experiments on the toxicity of ethylene oxide to 4 species of insects are described in detail, and some of the results are compared with those obtained in work by himself and others, most of which have not been published, on sulphur dioxide and hydrocyanic acid gas, particularly with respect to the relation between concentration of fumigant, time of exposure and rate of mortality. With exposures of 5 hours, lethal concentrations, in milligrams per litre, of HCN and ethylene oxide at 25°C. [77°F.] and of sulphur dioxide at 20°C. [68°F.] were, respectively: 14·00, 8·40 and 8·30 for *Calandra granaria*, L.; 12·00, 4·10 and 10·80 for *C. oryzae*, L.; 0·36, 27·00 and 9·70 for *Tribolium castaneum*, Hbst.; and 0·17, 12·30 and 5·90 for *Cimex lectularius*, L. The considerable changes in the relative resistances of these insects cannot at present be explained. To find a simple criterion of resistance the general nature of time-concentration relations are considered. Haber's formula (ct=W) has been used to express the relation between concentration of fumigant and time of exposure that produces a constant mortality [*R.A.E.*, A **23** 121], but a deviation due to toleration of low concentrations has been observed by several workers. This deviation is met by the empirical formula $c^n t = W$, which gives a linear relation when converted to logarithms. No consistent deviations from the latter formula were shown by the four test insects. The value for n must be determined for each species of insect, because some are relatively more resistant to long exposures than others. It is sometimes considerably higher than unity [*cf.* **24** 171]; for *T. castaneum* and ethylene oxide it was 1·5.

The following is taken from the author's summary: The different circumstances to be considered in fumigation research are surveyed with a view to ensuring reliable results. They can be grouped as two sets of factors, those that may influence absorption of poison, and those that may influence toxic processes and degree of poisoning. These factors are assessed, and each aspect of technique is described, with an estimate of the extent to which it has been controlled. The difficulties of estimating mortality are considered, and a relation between severity of fumigation and incidence of death or recovery from stupefaction is demonstrated. The dose-kill data are treated by Bliss's Method of Probits [**22** 440], and tables of statistics for each set of data are appended. The need for uniformity in the expression of toxicity is stressed, and the following criterion of resistance proposed: "The 5-hour concentrations (in milligrams per litre at normal temperature and pressure) for percentage mortalities of 50 and 99, and the value of n."

Taylor (W. L.). **Birds and British Forestry.**—*Forestry* **12** no. 1 pp. 1–9, 17 refs. London, 1938.

The author states that little is known of the relation of wild birds in Britain to forest economy or of their status as insect eaters. He concludes that the available knowledge of the dietary and habits of birds is fragmentary, and that the upsetting of the balance of nature has resulted in their environment being mainly artificial. For the benefit of forestry, they should be distributed proportionately as to

numbers and as widely as practicable. The provision of nesting-boxes is desirable, particularly in coniferous forests, to which birds feeding wholly or partially on insects will be attracted if some belts of deciduous trees are included. In Germany, the necessity of at least two nesting-boxes per acre for protection against damage by Lepidopterous larvae is indicated ; and it has been proved that the encouragement and protection of birds promises success in combating insect attack only when used as a preventive and not as a curative measure.

TRÄGÅRDH (I.). **An Outline of Rules and Directions to be adopted against Forest Insects in Sweden.**—*Forestry* **12** no. 1 pp. 10–14. London, 1938.

The author points out the importance of proper forest management to reduce the losses caused by insect pests, and outlines the principles that should be adopted in Sweden, many of which would also be applicable to other countries.

Before regenerating a forest, cones and seeds should be examined internally for insects. When seed-trees are left in a pine forest, stumps should be barked, as *Myelophilus* (*Blastophagus*) *piniperda*, L., breeds in them in the spring after the cutting, and the next generation attacks the shoots of the seed-trees, causing the latter to die or suspend seed-production for 3 or 4 years. Selection cutting should be practised in preference to clear cutting [*cf. R.A.E.*, A **17** 658], as the latter gives rise to an abundance of *Hylobius abietis*, L., and *H. pinastri*, Gylh., in the spring 2 years later. Damage by these weevils may be considerably reduced if the young plants are sufficiently vigorous (4–5 years) or so small (1 year) that they escape injury. These measures also apply to *Hylastes ater*, Payk., and *H. cunicularius*, Erichs. Severe infestations by such primary insects as the pine-shoot moth [*Rhyacionia buoliana*, Schiff.], which destroy the stem form, may occur unless cultures and regenerations are as dense as possible.

No special measures are necessary if pines or spruces are thinned when quite small. Pines of which the diameter at the base exceeds 3·5 cm. should not be cut until after the flight period of *M. piniperda* ; those cut between then and early autumn may be left on the ground as they will only be attacked by secondary insects of no importance in the following spring.

Suppressed and backward trees in older stands should be removed ; *Myelophilus* spp. and *Pissodes pini*, L., breed in pines with undersized crowns, and the common occurrence of *H. abietis* in a stand means that thinning has been neglected. Suppressed spruce of the fourth crown layer succumbs to the attack of *Pityophthorus* (*Pityogenes*) *micrographus*, L., *Cryphalus abietis*, Ratz., or *C. saltuarius*, Weise. On dry sandy soil with a low ground-water level, the propagation of *Pissodes piniphilus*, Hbst., is favoured by exceptionally dry summers and the attack cannot be prevented. Its feeding and oviposition cause large white mirror-like patches of resin in the top of the stems ; it breeds in the crowns, and the following year the pines succumb to the combined attack of *M. piniperda* and *M. minor*, Htg., and form centres for an outbreak of these insects, unless they are promptly controlled by barking the trees.

Logs must not be left unbarked in the forest during the summer, because of the probable joint attack of bark-beetles and blue-stain fungi. If it is impossible to remove the logs at the proper time, they

should be stacked in the largest possible piles in the darkest and dampest places and covered by a thick layer of moss [*cf.* **23** 224]. Slash may be used as traps, but should be barked before the end of June to destroy the brood.

The forester should be familiar with the initial symptoms of attack. *M. piniperda* and *M. minor* stop or distinctly lower the growth of young pine shoots, and the injured trees always contain brownish white dust in the crevices of the bark. These trees should be used as traps and should not be barked to destroy the brood until oviposition has ceased. Felling and barking in autumn is sufficient to control *P. pini*, which often starts its attack on bark wounded by the felling of other trees, as its metamorphosis is not completed until the following year. Infestation of spruce by *Ips typographus*, L., is occasionally shown by slightly discoloured needles. If it starts low down, the boring dust is easily detected, and if it is higher up, field-glasses should be used to detect entrance holes; needles and dust will fall if the trunk is beaten.

It is important to be prepared for storms, fire, snow-break, inundations and exceptionally dry seasons, which favour the propagation of bark-beetles.

PHILLIPS (E. W. J.). **The Depletion of Starch from Timber in Relation to Attack by *Lyctus* Beetles. I. Starch, with special Reference to its Occurrence in Timber.**—*Forestry* **12** no. 1 pp. 15–29, 1 fig., 1 pl., 56 refs. London, 1938.

The following is the author's summary: This paper forms an introduction to a series dealing with practical methods of depleting timber of its starch content with a view to rendering it immune to attack by *Lyctus* powder-post beetles [*cf. R.A.E.*, A **24** 550]. The available information on starch is summarised and considered with special reference to this problem. Variations in the structure, composition and physical properties of starch are noted. Several chemical methods of starch determination are mentioned, and a visual method for estimating the amount and distribution of starch in timber is described. The storage system of trees and the physiology of reserve food materials (especially starch) are described and discussed. Finally, the principles of starch depletion and the difficulties involved in various practical methods are considered.

PARKIN (E. A.). **The Depletion of Starch from Timber in Relation to Attack by *Lyctus* Beetles. II. A preliminary Experiment upon the Effect of Girdling standing Oak Trees.**—*Forestry* **12** no. 1 pp. 30–37, 1 pl., 15 refs. London, 1938.

The following is the author's summary: Four oaks (*Quercus robur*) were girdled at the top of the main trunk through bark, phloem and cambium in July 1935; two of the trees were also girdled near the base. One pair was felled after 5 months, the other after 17 months. In all four trees, the sapwood below the upper girdle was rendered devoid of starch and the presence of a lower girdle did not seem to accelerate the depletion. Stain and decay fungi entered the sapwood at the girdles, the deterioration being negligible after 5 months but rather marked after 17 months. The starch-free sapwood was shown to be unsuitable for the development of larvae of *Lyctus*.

Trappmann (W.). **Erprobte Mittel gegen tierische Schädlinge.** [Tested Preparations against Animal Pests.]—*Flugbl. Biol. Reichsanst.* no. 165/169, 31 pp. Berlin, May 1938.

This is a list of materials, including proprietary preparations, that have been officially tested for the control of pests in Germany. It consists mainly of insecticides, and shows the recommended formulae and the pests against which they are effective. A final section consists of a list of the pests, and under each a reference is given to the appropriate control.

Goidanich (A.). **La lotta contro la cecidomia delle perine** (*Contarinia pyrivora*, **Ril.**). [Control of the Cecidomyiid attacking young Pear Fruits.]—*Italia agric.* **73** pt. 1 repr. 7 pp., 5 figs. Rome, January 1936. [Recd. 1938.]

The number of pears infested by larvae of *Contarinia pyrivora*, Riley, was reduced from 272 per 100 trees in the controls to 11·23 in an orchard in Italy in 1935 by two applications, on 1st and 3rd April, respectively, of a proprietary insecticide containing nicotine sulphate. A little over 1 gallon of liquid was used per tree and the applications were made when the petals were appearing and showing pink ; this coincides approximately with the pre-oviposition period of females of the overwintering generation [*cf. R.A.E.*, A **25** 235, 766], which visit the flowers in search of nectar.

Bodenheimer (F. S.) & Steinitz (H.). **Studies in the Life History of the Citrus Mussel Scale** (*Lepidosaphes pinnaeformis* **Bché**) **in Palestine.**—*Hadar* **10** no. 7–8 pp. 153–159, 21 figs., 2 graphs, 6 refs. Tel-Aviv, 1937.

Lepidosaphes beckii, Newm. (*pinnaeformis*, auct.) was introduced into Palestine about 1912 on Valencia oranges imported from Spain, and subsequently spread rather slowly, mainly in the direction of the prevailing wind. It has been recorded on *Ceratonia* and *Yucca* in Palestine, and attacks all species of *Citrus*, preferring shadier trees that furnish protection from the wind and provide dispersed light. In one experiment, the scales were 16·5 times as numerous on the proximal as on the distal quarter of the branch, and counts in July and September showed that infestation on fruits in the interior and on the periphery of the tree was in the ratio of 13·4 : 0·1 and 53·7 : 4·4. Infestation was often sporadic, even in the same orchard. In 1935, when the infestation was medium, the percentages of fruits unfit for export owing to damage by the scale were less than 5 in one locality and apparently approached 60–100 per cent. in another. As the hanging branches of grapefruit trees afford the essential protection, these trees are infested earlier and are prone to heavier infestations than young orange trees.

In rearing experiments, 60·6 per cent. males were obtained ; the yearly average percentages of living males (36 on the leaves and 50 on the full branch) were explained by the adult female scales living and adhering much longer than the males. From May to July 1935, 60 per cent. of the offspring of 10 parthenogenetic females were males. Although parthenogenesis occurs freely, the usual finding of sperms in females showed that pairing is normal. Neither males nor females showed a preference for either side of the leaf. The life of the male was

as short as that of other Coccids. In summer, oviposition lasted 9–10 weeks, towards the end of which period the eggs began to hatch; the average number laid by females on *Citrus* leaves in the laboratory was 172. The maximum number of eggs and first-instar larvae occurred in July and August, respectively. The number of eggs laid differed little on different species of *Citrus*, but was 54–77 per cent. greater on fruit than on leaves. It appeared that only 30–50 per cent. as many eggs were laid in summer as in spring. The minimum periods required to complete the life-cycle were 44 and 50 days for the male and female, respectively, in summer, and 110 days for the female in winter. In orange groves, 4 generations a year were observed, beginning in April, late June, late August and early September, and November–January, respectively. About 5 per cent. of the scales were on fruits, and practically all the others on leaves.

Details are given of statistical counts during 1934–35. The population minimum occurred in June–July and the maximum in December–January. Mortality was high owing to the dry desert winds in spring, and to a less extent in autumn; it was lowest in January and February. The average annual fluctuation was 13–29 per cent. The decisive months for annual increase were July–August in 1934, and May–June in 1935, when the temperature was 25–27°C. [77–80·6°F.] and the relative humidity 75–79 per cent. The average numbers of settled larvae per female were 28·2 in positive breedings alone and 21·0 in all breedings, with a maximum of 97. Mortality was highest among the crawlers, which could be blown away by the wind; it was also increased by the annual picking of the fruit and the premature dropping of heavily infested leaves.

The crawlers usually settle close to the parent scale, but tend to migrate, to a very limited extent, in spring, when they settle slowly on the young twigs and later on almost fully grown leaves. Below 15·3°C. [27·54°F.], activity practically ceased. Over 90 per cent. of all scales on the fruit originated from the larvae that began to settle below the sepal at the end of April. Infestation became heavy when those of the second generation hatched about mid-July, because most of them remained on the fruit and more eggs were laid there. Newly planted orchards may become infested permanently by other scales if even a few individuals are transported with the nursery stock, but orange seedlings artificially infested with *L. beckii* in April were completely clean 2½ months afterwards, and they resisted later infestations. The average orchard was usually not infested permanently before it was 9–10 years old.

No Hymenopterous parasites of the scale were observed. The Coccinellid, *Chilocorus bipustulatus*, L., preyed on it from February to April, but was not sufficiently abundant to reduce its numbers. Larvae of a small Coniopterygid, which were occasionally parasitised by *Aphanogmus steinitzi*, Priesn., were found sucking larvae of the scale.

KLEIN (H. Z.). **Experiments in spraying with White Oil Emulsions against Citrus Mussel Scale.**—*Hadar* **10** no. 11 pp. 221–223 (repr. 8 pp.) 2 refs. Tel-Aviv, 1937.

An account is given of preliminary experiments in Palestine in 1937 with sprays of 2½ per cent. white oil emulsion against *Lepidosaphes beckii*, Newm. (*pinnaeformis*, auct.) on *Citrus*. The name of the Coccid is

given erroneously in the original paper as *Pseudococcus citri*, but this is corrected in the reprint.

Single applications of spray in July, August and September gave 80·1, 83·7 and 75·3 per cent. control, respectively, all of which are insufficient. The summer-generation larvae appear in July and reach maturity in September; the eggs and first-instar larvae are most numerous in July and August, respectively [*cf.* preceding abstract]. Since the immature stages are more sensitive to spraying than the adults, mortality among them was greater. The same is true of mortality due to climatic factors, the natural mortality being 6·7, 6·9 and 2·0 per cent. in July, August and September, respectively.

The natural monthly increase (calculated by comparing the number of live scales 1 and 4 weeks after spraying) was 4·4 in July and 5·5 in August. The population did not increase during one generation when 3 sprays were applied at intervals of 3 weeks starting at the end of July; or 2, with an interval of 6 weeks, in July and August, or in August and September.

Details are also given of the percentages of withered scales in control and sprayed plots; these are adults of the preceding generation that have died after oviposition. The actual mortality of adults caused by spraying could not be clearly demonstrated. Females were transferred to test-tubes a week after the September spraying, and counts of the larvae that hatched in the next 3 weeks showed that the egg mortality percentages after 3 sprayings (July, August and September), 2 sprayings (July and September) and 1 spraying (September) were 99·3, 98·8 and 64·5, respectively, as against 0 in the controls.

Prodenia litura (**Boisd.**). **An Insect Pest of Berseem Clover.**—*Palestine Gaz.* no 790 Agric. Suppl. no. 30 pp. 122–128. Jerusalem, June 1938.

Investigations have been carried out since 1934 at Acre on the bionomics and control of *Prodenia litura*, F., which is a serious pest of berseem [*Trifolium alexandrinum*] and lucerne in Palestine and occasionally damages young plantations of *Citrus* and vines.

The adults are active at night and are especially attracted to fields of berseem irrigated about 9 days previously. The females lay up to 2,000 eggs each in batches of 80–130 on the twigs or lower surfaces of the leaves. Oviposition begins 5–8 days after emergence and continues for a considerable period, but is most intense during the first few days. When young, the larvae feed by day on the lower surfaces of the leaves in groups covered by fine webs. After the second moult, they hide during the day under soil, or at the base of berseem plants where these are very thick, and emerge at night to feed on the upper parts of the plants. They often migrate from cropped or flooded land or from dry headlands. Pupation takes place in an earthen cell in the soil. In summer, the egg, larval and pupal stages lasted 4–6, 18–24 and 7–10 days, respectively. There are 5 overlapping generations a year; the first adults appear about the end of April and the last larvae enter the soil in late October or early November. The first generation is usually small. The greatest damage to berseem and lucerne is caused in July–September, but berseem sown in October is liable to severe injury by larvae of the last generation.

Paris green was formerly used as a dust against the larvae, but was not satisfactory, owing to the danger of poisoning livestock and

variations in its composition and physical properties. Experiments showed that the larvae living in the soil and attacking the crops at night could be satisfactorily controlled by baits of 1 lb. sodium or barium fluosilicate mixed with 10–15 lb. bran, preferably with the addition of about ½ lb. sugar. The bran and fluosilicate should be mixed and moistened, and the sugar added in the form of a thick syrup. The bait should be continually moistened if kept, even for 1–2 days, and it should be applied in the late afternoon at the approximate rate of 2 lb. fluosilicate per 1,000 sq. ft; it lost its efficiency when dry. It did not affect the growth or yield of the crop, and could also be used as a barrier to check migrating larvae. First- and second-instar larvae were controlled by dusts of 1 part barium fluosilicate mixed with 1–2 parts flour, which retained their toxicity for 3–4 weeks.

King (C. B. R.). **Report of the Entomologist for 1937.**—*Bull. Tea Res. Inst. Ceylon* no. 18 pp. 28–34. Talawakelle, 1938.

The tea tortrix [*Homona coffearia*, Nietn.] was little in evidence in Ceylon during 1937; its numbers have steadily declined for the last 10 years and it is now practically a minor pest. Further liberations were made of the species of *Macrocentrus* introduced from Java for its control [*cf. R.A.E.*, A **26** 337]. This parasite was established over an area of probably not less than 1,000 acres at the end of the year. Since the *Homona* population increases between July and January, releases in new areas should be made in September and October. No important enemies of *Macrocentrus* have yet been found; of 4 hyperparasites, 3 are usually primary parasites of *Homona*, while the fourth, which is a true hyperparasite, occurs in both Java and Ceylon, but very rarely attacks *Macrocentrus*.

Infestation of tea by nettle grubs [Limacodids] differed little from that of the previous year [**25** 671]. The commonest species was *Natada nararia*, Moore, but there was a severe outbreak of *Parasa lepida*, Cram., in one locality in November. The only two parasites observed were *Fornicia ceylonica*, Wlksn. (with a 25 per cent. hyperparasitism by *Calliceras* sp.) and *Rhogas* sp., both being commonest in July and August. A newly recorded Limacodid, *Oxyplax ochracea*, Moore, appeared on tea in February, but is thought not to be of any economic importance. The egg stage lasted 9 days at 73°F., and the pupal stage 26–27 days at 78°. The duration of the larval stage at 76° was 80–97 days on tea and 72–73 on dadap [*Erythrina*].

Voûte (A. D.). **Bevolkingsproblemen III. De groei van een klanderpopulatie, wanneer emigratie uitgesloten is. Verzadigte en oververzadigte populaties.** [Population Problems. III. The Growth of a Population of *Calandra oryzae* when Emigration is not possible. Saturated and oversaturated Populations.]—*Naturk. Tijdschr. Ned.-Ind.* **98** pt. 2 pp. 97–102, 1 graph., 2 refs. Batavia, 1938. (With a Summary in English.)

Further observations in Java [*cf. R.A.E.*, A **26** 311] in which 8 males and 8 females of *Calandra oryzae*, L., were placed in each of 3 small samples of rice, the actual amounts of which are not given, showed that after reaching about 700–900, populations did not increase further. The author considers that as emigration was prevented and the number of eggs laid did not decrease, this was caused

by the adults eating grains of rice in which there were larvae or pupae. For the quantities of rice used, saturation was apparently reached with a population of about 200, as above this figure emigration occurred where possible. In an over-saturated population, the weevils became restless and were positively phototactic, which was not the case with a less dense population. The influence of population density on daily egg-production was investigated by dividing a total of 400 weevils on successive days into groups of 25, 50, 100, 200, 300 and 400. The average numbers of eggs laid per weevil in these groups were 0·31, 0·29, 0·31, 0·29, 0·17 and 0·08, respectively.

JOURDAN (M. L.). **Observations sur la biologie de la cecidomyie destructive** (*Mayetiola destructor* **Say**) **au Maroc.**—*Bull. Soc. Sci. nat. Maroc* **17** pt. 3–4 pp. 154–162, 5 refs. Rabat, May 1938.

An account is given of laboratory and field studies on *Mayetiola destructor*, Say, on the Atlantic coast of Morocco. Observations were made on emergence of adults from pupae in stubble collected after harvest, and from some of which the time of pupation in artificially-infested culms was known ; both series were kept in cages in the open air as well as in the laboratory, where they were watered after the first rains. Pupae were also collected from unploughed stubble after the rains. Records were kept of the dates of infestation of young cereals in field crops and in experimental plots sown at different times.

In 1936–37, the rainy season lasted from October to May, and during this period the life-cycle was not completed in less than 41 days and usually required 50–60, with a maximum of 83. Tables are given showing the monthly temperatures out-of-doors from October to April, the numbers of adults emerging on different dates, and the variation in length of the life-cycles of individuals reared from eggs laid on the same day. The maximum and minimum temperatures in the laboratory during the autumn and winter averaged 21 and 17°C. [69·8 and 62·6°F.] and were, on the whole, much higher than those in the field. This difference in temperature did not appear to affect the length of the life-cycle at any given time of the year.

M. destructor passes through the third larval instar and the pupal stage inside a case formed by the skin of the second-instar larva and known as the puparium. Only the third-instar larvae survive the dry season, during which they remain in diapause, pupating after the rains begin. The adults emerged over several months from the beginning of October, about 20 days after the first autumn rains, and were most abundant in December. In some cases, diapause began during the rainy season (even as early as December) and it may be considerably prolonged. It therefore appears to be not entirely seasonal in character. On the other hand, some larvae pupate just before the end of the rains, but the resulting adults often live only 1–2 days and may die without ovipositing, while even if eggs are deposited and hatch the larvae generally die before reaching the third instar, as the hardened plant tissues are unsuitable for food.

The potential number of generations occurring annually is discussed in detail. Although it would be possible for four to complete their development, it is considered that there are usually two, with a partial third.

In rearing experiments carried out at Casablanca, Hudault found that, in individuals with a life-cycle of 10 weeks, the durations of the

egg stage, the first two larval instars together, the stages spent within the puparium, and the pre-oviposition period were, respectively, 5–7, 40–50, 13–20 and 3–5 days.

Bleton (C. A.). **Note sur** *Pachytychius strumarius* **Gyll. (Coléoptères-Curculionidae), parasite des pois au Maroc.**—*Bull. Soc. Sci. nat. Maroc* **17** pt. 3–4 pp. 197–202, 1 ref. Rabat, May 1938.

At intervals during the last few years, peas growing on the fertile plains in north-western Morocco have been seriously damaged by larvae of *Pachytychius strumarius*, Gylh., the immature stages of which are briefly described. There are two generations annually. The overwintered (second-generation) adults emerge in small numbers in March and April and appear on the peas when they are about to flower. They pair about a fortnight after emergence, and oviposit very soon afterwards on the young pods or on the flowers. The larvae make superficial galleries in the pods and burrow into them to feed on the peas. When full-grown, they drop to the ground and pupate in earthen cells, which are generally close to the soil surface in the summer and deeper in the winter. The first-generation adults are present in the field from 10th to 25th May; they die soon after pairing and oviposition. Larvae of the second generation become full-grown and pupate in mid-July. The pupal period lasts 8–10 days, but the adults remain in the earthen cells and do not emerge until the following spring.

The larvae and adults feed on all varieties of peas and also on *Lathyrus sativus*, lentils and wild vetches (*Vicia*), but not on chick peas (*Cicer arietinum*); the adults generally do very little harm. Some varieties of peas are more severely injured than others. In 1936, the average damage was estimated at 30 per cent.; in 1937 the whole crop was infested in some areas. Larvae of the second generation destroyed all the seed of *Lathyrus sativus* on some plots. In a field of lentils where there was a heavy initial infestation, most of the larvae failed to develop beyond the first instar, on account of the small size of the pods; in this case, however, the adults fed on the young pods, causing deformation.

Io (Chou). **Ridescrizione dell'** *Aspidiotus destructor* **Sign. (Homoptera, Coccidae).**—*Boll. Lab. Zool. Portici* **30** pp. 240–249, 9 figs. Portici, 4th June 1938.

All stages of *Aspidiotus destructor*, Sign., are redescribed, and its food-plants and geographical distribution are noted. In Italian Somaliland, where this Coccid occurs on fruits of banana, the author has observed pupae and adults of *Aphytis chrysomphali*, Merc., under its scales.

Rungs (C.). **Remarques sur les variations de** *Micrococcus similis* **Leon. Parasite des céréales au Maroc (Hem. Coccidae).**—*Bull. Soc. Hist. nat. Afr. N.* **29** no. 5 pp. 392–396, 2 refs. Algiers, 1938.

A list is given of the species of the genus *Micrococcus*, and the characters of *M. similis*, Leon., *M. silvestrii*, Leon., and a species of *Micrococcus* taken on the roots and root-collars of wheat, barley and oats in western Morocco in the winter of 1937–38 are compared. Individuals of the Moroccan form showed considerable morphological variations and a certain number of characters intermediate between

those of *M. similis* and *M. silvestrii*, but there was a sufficient predominance of characters coinciding with those of *M. similis* to enable it to be referred to that species. Moreover, it appears that *M. similis* always attacks the roots of graminaceous plants, whereas *M. silvestrii* has been found only in ants' nests.

HARRIS (W. V.). **Annual Report of the Entomologist for the Year 1937.** —*Ent. Leafl. Dep. Agric. Tanganyika* no. 16, 8 pp. Dar es Salaam, 1938.

Little damage was done by cotton pests in Tanganyika Territory in 1937, but the pink bollworm [*Platyedra gossypiella*, Saund.] was found in December in the Lake province, where it had not previously been recorded. Adults and nymphs of *Dysdercus fasciatus*, Sign., and *D. cardinalis*, Gerst., were parasitised by a Tachinid ; 3 and 20 per cent., respectively, of the females were attacked in a patch of scrub and *Sterculia appendiculata* known to be a permanent breeding ground of stainers, but the percentage parasitised on cotton was very low. Other insects attacking cotton included *Brachytrypes membranaceus*, Dru., which was locally injurious in sandy areas, and *Argyroploce leucotreta*, Meyr., and the Lamiid, *Analeptes* (*Diastocera*) *reticulata*, Thoms., neither of which had previously been recorded as a pest of this crop.

Observations have shown that stored cowpeas and *Sorghum* are liable to severe damage by weevils. When untreated *Sorghum*, initially free from infestation, was stored in a comparatively clean building for 11 months, the loss in weight was 23 per cent. ; this was reduced to 12, 6 and 3 per cent., respectively, in *Sorghum* treated with lime (1 : 50), sodium fluosilicate (1 : 1000) and sodium fluoride (1 : 1000). The lime was probably the most practical treatment, and it alone would be safe for use on crops stored for food. In a similar test with cowpeas, however, lime was completely ineffective, though sodium fluosilicate gave a high degree of protection. It could be applied if the cowpeas were used for seed or were subsequently washed.

Zonocerus elegans, Thnb., is of importance as a pest of cassava in several areas ; hand collection in time to prevent oviposition is the best control method. Many adults are killed annually by a fungus (*Empusa*), but only after most of the eggs have been laid. Other injurious insects observed included : *Ootheca bennigseni*, Weise, on *Sesamum* ; *Mylabris aperta*, Gerst., *M. dicincta*, Bertol., and *Coryna apicicornis*, Guér., on pigeon-peas [*Cajanus cajan*] ; *Tortrix* (*Cacoecia*) *occidentalis*, Wlsm., on onion ; *Asphondylia* sp. on egg-plant (*Solanum melongena*) ; and *Euxoa segetum*, Schiff., *E.* (*Agrotis*) *longidentifera*, Hmps., *Lycophotia muscosa*, Geyer, and *Miselia inferior*, Gn., on tobacco. *Macrotermes* (*Bellicositermes*) *bellicosus*, Smeath., damaged transplanted clove seedlings, and *Synacanthotermes zanzibarensis*, Sjöst., *Coptotermes amanii*, Sjöst., and *Calotermes* (*Cryptotermes*) *havilandi*, Sjöst., attacked timber. Locusts were negligible ; only *Nomadacris septemfasciata*, Serv., was present.

MENDES (D.). **Nota sobre** *Maruca testulalis* **(Geyer 1832) (Lep. Pyralidae).**—*Rodriguesia* **3** no. 10 pp. 167–169, 1 pl., 7 refs. Rio de Janeiro, 1937.

Maruca testulalis, Geyer, the adult and larva of which are described, was observed in May 1935 attacking *Mucuna huberi* in Brazil, where it

occurs also on beans (*Phaseolus* sp.). Notes are given on the damage caused to the flower buds and pods, which is similar to that recorded on lima beans in Porto Rico [*R.A.E.*, A **22** 153].

BONDAR (G.). **Cancro dos fructos de cacáo, causado por** *Monalonion xanthophyllum*, **Walk. "Chupança de cacáo."** [A Canker of Cacao Fruits caused by *M. xanthophilum*.]—*Rodriguesia* **3** no. 10 pp. 179–186, 2 figs., 2 pls. Rio de Janeiro, 1937.

The information in this paper on the Capsid, *Monalonion xanthophilum*, Wlk., which causes a canker of the fruits of cacao in Bahia, Brazil, is almost identical with that in a previous one [*R.A.E.*, A **17** 159], but it is stated that the identity of the wild food-plant that it prefers is uncertain. The bug is rare or absent on cacao grown under shade.

DANIELS (L. B.). **Controlling Colorado Potato Pests.**—*Bull. Colo. Exp. Sta.* no. 437, 35 pp., 17 figs., 10 refs. Fort Collins, Colo., October 1937. [Recd 1938.]

An account is given of the bionomics of *Paratrioza cockerelli*, Šulc [*cf. R.A.E.*, A **26** 578], flea-beetles and *Leptinotarsa decemlineata*, Say, which are the major pests of potato in Colorado, and of measures for their control. The commonest flea-beetle on potato is *Epitrix cucumeris*, Harr., but it is replaced in the western part of the state by *E. parvula*, F.; *Systaena taeniata*, Say, occasionally occurs in large numbers.

The flea-beetles can be controlled by dusts of calcium arsenate and lime (1 : 8) or cryolite, but a spray of 2 lb. zinc arsenite in 50 U.S. gals. water is preferred. This spray or one of Paris green (1 lb. in 50 U.S. gals.) is effective against *Leptinotarsa*. The Psyllid is best controlled by a spray of 1 gal. liquid lime-sulphur (which should have a high polysulphide content and a specific gravity of 32° Bé.) in 40 gals. water, delivered at a pressure of 200–300 lb. During the last two or three years, a combination spray of 2 lb. zinc arsenite, 1 U.S. gal. lime-sulphur and 40 U.S. gals. water has been extensively and successfully used against all these pests in Colorado. An account of spraying and dusting equipment is appended.

Entomology and Zoology.—*Rep. S. Carolina Exp. Sta.* **50** (1936–37) pp. 52–60. Clemson Coll., S.C., December 1937.

Insect pests were normally abundant in South Carolina during 1937. O. L. Cartwright reports that the use of bait traps and adhesive screens [*cf. R.A.E.*, A **25** 630] was supplemented by general observations in a further attempt to follow the activity of adults of the rice weevil [*Calandra oryzae*, L.] in the field during the spring and summer, and gives records of the numbers caught in various situations. Three generations developed in stored maize between 16th April and 4th August. In one locality, 24·7 per cent. of the ears of maize examined at the time of harvest were attacked by *C. oryzae*, 60·5 per cent. by the corn earworm [*Heliothis armigera*, Hb.], 31·7 per cent. by the pink corn worm [*Pyroderces rileyi*, Wlsm.], 53 per cent. by flour beetles [*Tribolium* spp.] and 7·6 per cent. by the angoumois grain moth [*Sitotroga cerealella*, Ol.]. Similar data for two series of variety plots are given. Preliminary experiments with an extremely

finely ground natural silicic acid dust against insects in stored maize, wheat and peas gave excellent results ; the dust was non-poisonous and economical and gave promise of permanent protection. Further observations on infestation of maize by the southern corn stalk borer [*Diatraea crambidoides*, Grote] confirmed previous recommendations as to dates of planting [*loc. cit.*]. The oriental fruit moth [*Cydia molesta*, Busck] damaged 1, 12½ and 50 per cent. of the peaches in three different localities ; parasitism was highest in the third in mid-July, when 27 per cent. of the larvae were destroyed.

J. G. Watts observed that *Frankliniella fusca*, Hinds, was more abundant than *Sericothrips variabilis*, Beach, and *F. tritici*, Fitch, on seedling cotton [*cf. loc. cit.*], and that more damage was caused than in 1936. Blossoming and fruiting records showed that 29·8 and 10·2 per cent. of the blooms on normal and injured plants, respectively, opened in July, 70·0 and 89·7 per cent. in August, and 0·2 and 0·1 per cent. in September ; there were only 58 per cent. as many blooms on the latter as on the former, with a corresponding yield of bolls. The insecticides tested against these thrips were a mixture of molasses, calcium arsenate and water (1 : 1 : 2), which was the most effective, sulphur dust, which was more effective when used alone than when mixed with various arsenicals, and a dust of thiodiphenylamine (phenothiazine) and talc (1 : 9), which gave the smallest reduction of infestation. The resistance to thrips of different varieties of cotton, as measured by the percentage of injured stalks, is shown in a table, and varied by 18·38 per cent. The squash bug [*Anasa tristis*, DeG.] caused considerable injury to watermelons. Hand picking is the most effective method of control, and is particularly so if carried out about 50–75 ft. behind workers applying sprays against other insects or fungi, as any spray causes the bugs to crawl to the upper side of the leaves.

F. Sherman and J. N. Todd report that, although the percentage emergence of the Mexican bean beetle [*Epilachna varivestis*, Muls.] in hibernation cages was the highest observed in 12 years, the heavy infestation expected was partly offset by the small number of beetles present in the previous autumn. In experiments by Sherman, the tomato fruit worm [*Heliothis armigera*, Hb.] caused injury to 28 out of 139 otherwise sound tomatos in pickings on 6th, 15th and 20th July, but to only 4 out of 1,082 in pickings on 5th, 12th and 19th August, so that treatment is only necessary early in the season. The main harvest follows abundant silking of maize, and the moths apparently prefer to oviposit on the maize silks.

Bondy (F. F.) & Rainwater (C. F.). **Boll Weevil and miscellaneous Cotton Insect Investigations.**—*Rep. S. Carolina Exp. Sta.* **50** (1936–37) pp. 95–102. Clemson Coll., S.C., December 1937.

In experiments against the boll weevil [*Anthonomus grandis*, Boh.] in South Carolina in 1936, dust treatments applied 5 times gave control on fruiting cotton after the weevils had migrated from old to late cotton, about mid-August. Similarly good control was given by applications per acre of 10·1 lb. of a 1 : 2 mixture of calcium arsenate and lime, 8·9 lb. of a 1 : 1 mixture or 8·6 lb. calcium arsenate alone. Treatment was cheapest per 100 lb. gain of seed cotton when the 1 : 2 mixture was used.

In 1937, pre-square applications of mopping mixtures containing calcium arsenate, water and sweets (molasses, sugar-cane syrup, or maize syrup) or other materials (agar agar, casein, or blood albumen) as thickeners or carriers gave no appreciable control. In dusting experiments, calcium arsenate, alone or mixed with lime or sulphur, was more effective than pyrethrum and sulphur (1 : 9), cryolite, or barium fluosilicate and talc (1 : 2).

The need for controlling root Aphids on cotton in the coastal plains of South Carolina has become increasingly evident in the last four years. The chief species, in order of abundance, are *Anuraphis maidi-radicis*, Forbes, *Trifidaphis phaseoli*, Pass., and *Rhopalosiphum* sp. Infestation by them often results in the cotton starting to die when the third and fourth leaves are forming, hundreds of Aphids being present on a single plant. Small amounts of insecticides (80 lb. creosote, 50 lb. calcium cyanide, 400 lb. ground tobacco stems and leaves, 100 lb. flake naphthalene, 80 lb. ground derris root (4 per cent. rotenone) or 100 lb. sulphur, per acre) were thoroughly mixed with a fertiliser and applied to the soil before planting, but resulted in no significant difference in the number of Aphid colonies, in the percentage reduction in stand, or in the boll counts ; plant growth was not affected.

Allen (N.), Humphreys (J. W.) & Hookom (D. W.). **Experiments in Control of the Tobacco Flea Beetle during 1937.**—*Rep. S. Carolina Exp. Sta.* **50** (1936–37) pp. 112–117, 4 figs. Clemson Coll., S.C., December 1937.

The following is substantially the authors' summary of the results of dusting experiments against *Epitrix parvula*, F., on tobacco in South Carolina. A cubé dust containing 1 per cent. rotenone was more effective than one containing 0·5 per cent. or a 36 per cent. cryolite dust, when applied at the same rate. The best results with it are obtained by increasing the rate of application from about 8 lb. per acre when the plants are small to 10 lb. or more when they are mature. Although the flea-beetles caused more injury on plants dusted at the peak of emergence of each successive brood than on plants dusted more often, commercial control was obtained in both cases.

Franklin (H. J.) & others. **The Cranberry Station, East Wareham, Massachusetts.**—*Bull. Mass. agric. Exp. Sta.* no. 347 (Rep. 1937) pp. 42–45. Amherst, Mass., March 1938.

In 1937, cranberries near grape-vines in Massachusetts were again attacked by larvae of the Rutelid, *Anomala errans*, F. [*cf. R.A.E.*, A **25** 715]. The effectiveness against *Anthonomus musculus*, Say (cranberry weevil) of a single application of undiluted pyrethrum dust (1·6 per cent. pyrethrin content) at the rate of 100 lb. per acre [**25** 716] was confirmed ; but a single application of a spray containing 15 lb. derris powder (4 per cent. rotenone content) and ½ lb. Areskap per 100 U.S. gals. water, at the rate of 400 U.S. gals. per acre, was ineffective. *Anthonomus* was more abundant than usual.

Infestations by *Cryptocephalus incertus*, Ol. (fire-beetle) were the severest on record, the degree varying with the variety of cranberry. The beetles attack the upper more than the lower surface of the leaves, preferring the margins to the centre, and eat round some of the new

terminal buds. They are more active during August and early September than in the ensuing cooler weather. They were also abundant on leaves of *Vaccinium corymbosum* (swamp blueberry), *Gaylussacia baccata* (black huckleberry) and *Prunus maritima* (beach plum). Pyrethrum dust (0·9 per cent. pyrethrin content), applied at the rate of 100 lb. per acre in early September, gave less than 50 per cent. control. When used at the rate of 250 U.S. gals. per acre, a spray containing 2 lb. lead arsenate in 100 U.S. gals. water gave almost complete control. Lead arsenate should not be applied after mid-August, but one grower applied a spray containing 6 lb. per 100 U.S. gals. at the same rate at the end of the month. Some heavy rains fell before the berries were picked in early October. One sample of these showed 0·0255 and 0·01606 grains lead and arsenic trioxide, respectively, per lb. and another showed 0·006 grains arsenic trioxide, but a sample, picked after the bog had been flooded for 5 days, showed only 0·001 grains arsenic trioxide. When washed with a 2 per cent. hydrochloric acid solution, thoroughly rinsed, dried, and stored from 2–4 weeks, these berries kept well and sold successfully as fresh fruit.

Good control of the cranberry fruitworm, *Mineola* [*vaccinii*, Riley], was obtained by applications on 10th and 20th July, at the rate of 400 U.S. gals. per acre, of sprays containing 8 lb. derris, or 10 lb. cubé (both with 4 per cent. rotenone content) and 2 lb. soap in 100 U.S. gals. water. Coconut-oil soap and resin fish-oil soap were the most effective of the spreaders tested for these sprays. It seems advisable to apply sprays containing derris or cubé powder when three-quarters of the bloom is over, and again 10 days later ; also to determine the abundance and condition of the fruitworm eggs before spraying a bog.

The tipworm, *Dasyneura* [*vaccinii*, Smith] was more abundant than usual, but the black-headed fireworm, *Rhopobota* [*naevana*, Hb.], was less so. The gipsy moth [*Lymantria dispar*, L.] was destructive in one area.

Bourne (A. I.) & others. **Department of Entomology.**—*Bull. Mass. agric. Exp. Sta.* no. 347 (Rep. 1937) pp. 54–68. Amherst, Mass., March 1938.

Results of experiments on various pests are summarised in this account of work in Massachusetts during the year ending 30th November 1937.

Applications of a pyrethrum dust for the control of the white apple leafhopper [*Typhlocyba pomaria*, McAtee] caused most of the leafhoppers to fall from the leaves, but many recovered and reinfestation was rapid. A dust of lime containing 2·4 per cent. nicotine gave good control. Sprays of nicotine or pyrethrum, with soap, also greatly reduced the numbers of leafhoppers on the trees, but whereas the former resulted in a progressive decline in population, the latter was followed by reinfestation in a few days. In the laboratory, a complete kill was effected in 24 hours by dusting with pyrethrum, even when it was applied to the leaves before the leafhoppers were confined on them, and by spraying with pyrethrum or nicotine, the effectiveness of all treatments being slightly greater at 80°F. than at 60 or 70°. Nicotine and pyrethrum insecticides were ineffective against the European red mite [*Paratetranychus pilosus*, C. & F.] on apple, but a cyclohexylamine derivative gave good control.

In experiments against *Dasyneura mali*, Kieff. (apple leaf-curling midge), the best control of first-generation larvae [*cf. R.A.E.*, A **25** 718] was given by a spray of 6 lb. wettable cubé powder (3·65 per cent. rotenone) per 100 U.S. gals., with 3 lb. water-soluble diglycol stearate wax as a spreader and adhesive, which reduced the number of infested tips by 46 per cent., but slightly better results against the second generation were given by nicotine sulphate (1 : 800) with 3 per cent. molasses. Preliminary experiments showed that apples that measured approximately $\frac{5}{16}$ inches in diameter when sprayed with lead arsenate (4 lb. per 100 U.S. gals.) suffered about 3 times as much injury by the plum curculio [*Conotrachelus nenuphar*, Hbst.] as apples approximately $\frac{4}{16}$ inches in diameter when sprayed. When substituted for lead arsenate in four cover sprays, phenothiazine [thiodiphenylamine] was only slightly inferior to lead arsenate in the control of this weevil and of the codling moth [*Cydia pomonella*, L.], and avoided arsenical residue. The apple maggot [*Rhagoletis pomonella*, Walsh] caused practically no injury in well sprayed orchards.

Over 11,000 examples of *Macrocentrus ancylivorus*, Rohw., were liberated in late June and early July against the oriental fruit moth [*Cydia molesta*, Busck] on peach. Parasites liberated in 1934 [**23** 655] had almost died out. Quinces were very heavily attacked by *C. molesta*, and peaches were particularly severely infested in their immediate vicinity.

Sprays were consistently superior to dusts in the control of the squash vine borer [*Melittia satyriniformis*, Hb.], which was three times as numerous as in 1936. Each insecticide was applied four times at weekly intervals, and the percentage reduction of injury to the squash plants was 88·59 for a spray of 1 per cent. summer oil with 0·5 per cent. nicotine sulphate, 81·53 for a wettable cubé spray [*cf.* **25** 717], using 4 lb. in 100 U.S. gals. water, and 77·8 for a cubé-clay dust (0·6 per cent. rotenone). A pyrethrum-clay dust was ineffective.

In tests of insecticides for the control of the striped cucumber beetle [*Diabrotica melanocephala*, F.] on seedling melons, 5 applications were made between 10th June and 10th July [*cf.* **24** 491] and the control was estimated by counts made at various intervals of the beetles on treated and untreated plants. A spray of 4 lb. wettable cubé powder (3·65 per cent. rotenone) in 100 U.S. gals. water reduced the beetles by 90 per cent. and a cubé-clay dust (0·6 per cent. rotenone) by 85 per cent. Yield records corresponded with the control obtained.

Two applications of mercury bichloride (corrosive sublimate) at the rate of 1 oz. in 10 U.S. gals. water gave 98 per cent. control of the cabbage fly [*Phorbia brassicae*, Bch.], which infested cabbage more seriously than usual, and 82 per cent. large and medium heads were harvested. Dusting the roots at the time of transplanting with pure mercurous chloride (calomel) gave 92 per cent. control and a high yield. Mercurous chloride mixed with clay (1 : 1 or 1 : 3) gave less actual control, but afforded sufficient protection for a production of over 90 per cent. satisfactory heads [*cf.* **25** 717]. Dipping the roots in suspensions of mercurous chloride (at rates of up to 16 gm. per U.S. gal. water) with various adhesives gave inadequate protection as the suspension was too dilute ; the substitution of hydroxymercurichlorophenol (semesan) for mercurous chloride killed or severely injured the plants. Treating carrot seed with mercurous chloride alone and mixed with equal parts of clay protected 99 and 96 per cent., respectively, of carrots from attack by the carrot rust fly [*Psila rosae*, F.], but no

control was given by a 1 : 3 mixture. The addition of powdered gum did not increase the adhesion to the seed, and gave unsatisfactory results. A cubé-clay dust applied 4 times in June to carrots sown early in May gave complete protection.

Applications from 9th July to 12th August of insecticides mixed with Bordeaux mixture (5 : 5 : 50 and 5 : 3 : 50) for the control of flea-beetles [*Epitrix cucumeris*, Harr.] on potato indicated that rotenone, which gave the greatest reduction in leaf-punctures, nicotine tannate and a pyrethrum extract were more effective in the low calcium Bordeaux, while calcium arsenate gave equally good protection in both mixtures. July sprays resulted in widespread scorching and light yields. All the materials except nicotine tannate and the pyrethrum extract gave higher yields in the 5 : 5 : 50 combination, which caused less spray injury.

Field trials against the European corn borer [*Pyrausta nubilalis*, Hb.] on early maturing varieties of sweet maize were continued [*cf.* **25** 718]. Rains frequently interrupted the five-day schedule so that five applications of sprays and six of the dust were made between 10th June and 5th July. In plots treated, respectively, with a dual-fixed nicotine dust (nicotine tannate-bentonite [*cf.* **25** 410, 770]) and a derris spray, 6 and 5 per cent. of the plants showed stalk infestation, as compared with 36 and 12 per cent. in the controls, and injury to treated plants was not severe. In comparison with the untreated plots, those dusted and sprayed showed an increase over the controls of 225 and 1,692 total ears, and of 1,562 and 2,052 uninfested ears, respectively, per acre. In plots dusted as above and those sprayed with nicotine tannate and derris, uninfested ears formed 92·8, 97·6 and 98·3 per cent. of the total yield, respectively, compared with 70, 94·4 and 94·9 per cent. in the control plots.

Results obtained from further experiments in connection with the use of *Cryptolaemus montrouzieri*, Muls., against mealybugs in greenhouses [*cf.* **25** 719] showed that the percentage of eggs that hatched, the average duration of the larval stage and the average number of mealybug eggs eaten per larva per day were 38, 32·3 days and 37·6 at 80°F., but 50·7 per cent. of eggs hatched at 70°F. Preliminary tests indicated that an adult will eat about 3 mealybugs in 2 days at 80°F., and 1 at 60 and 70°.

The toxicity to the red spider [*Tetranychus telarius*, L.] on carnations and greenhouse plants of sprays containing rotenone [*cf.* **25** 719] increased with increased temperature, and was unaffected by the addition of wettable sulphur as a fungicide. The effectiveness of suspensions of derris, cubé or pyrethrum powder in water was less than that of their extracts, and was not increased by the addition of wetting agents. A commercial potassium-seleno-sulphide spray was only moderately effective. Lubricating oil emulsions were more effective at 60 than at 80°F., but a more volatile kerosene emulsion was more effective at 80°. Promising results were obtained in preliminary tests with certain naphthalene derivatives as fumigants.

Larson (A. O.) & Fisher (C. K.). **The Bean Weevil and the Southern Cowpea Weevil in California.**—*Tech. Bull. U.S. Dep. Agric.* no. 593, 70 pp., 28 figs., 98 refs. Washington, D.C., April 1938.

This paper comprises a detailed account of *Bruchus* (*Acanthoscelides*) *obtectus*, Say, and *Bruchus* (*Callosobruchus*) *maculatus*, F. (*quadrimaculatus*, F.) based on investigations carried out mainly in

California since 1919 and on the literature. The history, distribution, synonymy and economic importance of both Bruchids are reviewed, and all stages are described. They breed in many kinds of leguminous seeds, but prefer beans (*Phaseolus vulgaris*) and cowpeas (*Vigna sinensis*), respectively [*cf. R.A.E.*, A **15** 399].

The following is based on the authors' summary: The adults of these Bruchids live from a few days to over a month, depending on temperature and food supply. Although they drink water and liquid food from the leaves and other parts of the food-plant, this is not essential for the production of viable eggs [*cf.* **13** 184]. Adults of *obtectus* that were given no food or water survived for an average of 16 and a maximum of 23 days in July, but when they were given sugar solution, these periods were 66·7 and 176 days. The average numbers of eggs deposited by females in these two groups were 55·2 and 115. Females of *maculatus* given water and sugar solution lived 10 and 13–27 days more and deposited 30 and 50 per cent. more eggs, respectively, than those not fed. In winter, adults of *obtectus* and *maculatus* survived for up to 49 and 38 days, the females a day or so longer than the males. Their preoviposition periods lasted 24 and less than 1 hour in summer and 26 and 10 days in winter, respectively.

The two Bruchids differ in their manner of oviposition. In the field, *obtectus* finds or makes a suitable opening in the pod, inserts its ovipositor and lays a cluster of eggs. In storage, the eggs are deposited loosely among the beans. Eggs of *maculatus* are laid singly and attached firmly to the surface of pods or exposed seeds in the field or on seeds in storage. The maximum numbers of eggs laid per female were 209 for *obtectus* and 196 for *maculatus*. The eggs of both species hatched in 3–27 days, depending on temperature. The larval stage in warm weather lasted 17–25 days in *obtectus* and 17–22 in *maculatus*, and the pupal stage in the former exceeded 25 days.

In California, there are 5–6 generations of *obtectus* and 6–7 of *maculatus* in a year. If control measures are not applied, the population, which is large by June, continues to increase during the warm weather in the presence of a sufficient food supply. Fifty adults of *obtectus* placed in a bag containing 87 lb. red kidney beans gave rise to 250,000 adults in the course of 14 months and 50 of *maculatus* in 69 lb. cowpeas gave rise to 368,000 in 8 months. Normally, field infestations are due to adults that emerge from infested stored beans rather than from those that are planted. Measures for the control of infestations are very briefly discussed [**13** 515].

HAUG (G. W.). **Rearing the Coccinellid *Hippodamia convergens* Guer. on frozen Aphids.**—*Ann. ent. Soc. Amer.* **31** no. 2 pp. 240–248, 4 figs., 2 refs. Columbus, Ohio, June 1938.

Details are given of the technique employed in feeding adults of *Hippodamia convergens*, Guér., on frozen Aphids in Ohio, and the effect of this diet on egg-production. The method was evolved in view of the need for obtaining eggs of the Coccinellid at all times of the year for tests of ovicides, but it was also found that the larvae could be reared on frozen Aphids. The species frozen in large quantities were *Pemphigus populi-transversus*, Riley, *Rhopalosiphum pseudobrassicae*, Davis, *Macrosiphum onobrychis*, Boy. (*Illinoia pisi*, Kalt.), and *Longistigma caryae*, Harr., but *Pterocomma* (*Clavigerus*) *smithiae*, Monell, and *Aphis rumicis*, L., were also frozen successfully. Prolonged

cold storage caused no apparent change in their condition. On removal from a cold environment, *P. populi-transversus* decomposed and dried up less rapidly than the other species, and in the oviposition experiments only this species was used. The Aphids (or, in the case of *Pemphigus*, leaf-galls containing them) are packed in airtight glass containers and stored at −21 to −25°C. [−5·8 to −13°F.]. The Coccinellids are kept in separate cells in a cage of ½-inch strips of aluminium, with a floor of metal gauze and a sliding glass roof. It is lit from below, as the beetles are positively phototropic, and are thus kept close to the Aphids, which are placed twice daily on a sheet of glass clamped against the wire screen. A high relative humidity is necessary to prevent desiccation of the Aphids. Most of the eggs are deposited on the sides of the cells, from which they are easily removed with a camel's hair brush and water.

Old females of *H. convergens* collected in the field, and females reared entirely on the Aphids and paired with males so reared, both oviposited satisfactorily. *Adalia bipunctata*, L., was also reared on the Aphids, and *Coccinella trifasciata*, L., fed readily on them.

KEIFER (H. H.). **Eriophyid Studies.**—*Bull. Dep. Agric. Calif.* **27** no. 2 pp. 181–206, 20 pls., many refs. Sacramento, Calif., 1938.

Descriptions are given of 17 species of Eriophyids, including 9 new ones, collected in the *Citrus*-growing districts of southern California, with brief biological notes, and a list of the families and species of plants attacked. The collections were made to ascertain the food-plants and distribution of *Eriophyes sheldoni*, Ewing [*cf. R.A.E.*, A **26** 173] ; it was found only on lemon, and the places in which it occurred are shown on a map. The new species comprise *E. tulipae* on tulip bulbs said to have originated from Holland ; *E. cactorum* on *Opuntia* sp. ; *E. spinulifera* in Cecidomyiid galls on *Artemisia californica* ; *E. neosalviae* on *Salvia leucophylla* [*cf. loc. cit.*] ; *E. eriobotryae* on *Eriobotrya japonica* ; *Platyphytoptus* (gen. n.) *sabinianae* and *P. jonesi* on pines ; *Phyllocoptes ligustri* on privet (*Ligustrum* sp.), which has not previously been recorded as a food-plant of mites ; and *P. advens* on lemon, which is, however, thought not to be the plant on which it breeds. A new genus, *Phyllocoptruta*, is erected for the species formerly known as *Phyllocoptes oleivorus*, Ashm., which has been found only on lemons in California, though it infests orange in Florida. The other mites included *Eriophyes tristriatus erineus*, Nal., which is common on walnut (*Juglans regia*) ; some individuals were found on lemon buds but did not represent established infestations.

MICHELBACHER (A. E.) & ROSS (E. S.). **Drought damaged Poplars attacked by the Spotted Tree Borer, *Synaphaeta guexi* (Lec.).**—*Bull. Dep. Agric. Calif.* **27** no. 2 pp. 248–249, 1 fig. Sacramento, Calif., 1938.

Lombardy poplars [*Populus nigra italica*] growing in an area with a high water table in California had been in good condition until about 14 years ago, when continuous pumping was begun. As the water table receded, the trees died off, and a series of dry seasons increased the adverse conditions. When the trees were examined in 1933, *Synaphaeta guexi*, Lec., was breeding in them in large numbers, and

in May and June from one to six adults of this Lamiid could be collected from the base of a single tree. It is very probable that the trees were not seriously infested until they suffered from drought.

ROARK (R. C.). **Insecticides and Fungicides 1918–1938.**—*Chem. Industr.* **42** no. 6 pt. 1 pp. 636, 637, 639. New Haven, Conn., June 1938.

The author discusses the great increase in the use of insecticides, especially lead and calcium arsenate, that has occurred in the United States during the last 20 years, and the commercial use of new materials, particularly synthetic organic compounds and products derived from derris and cubé. A table shows the quantities of arsenicals, sulphur compounds, oils and organic compounds, plant insecticides, and fungicides used in 1936.

ROARK (R. C.). **Derris versus Cube. Is Cube equal to Derris as an Insecticide ?**—*Soap* **14** no. 1 pp. 111–113, 120. New York, N.Y., January 1938.

Examples are quoted of laboratory and field tests, which indicate that derris is more toxic to some insects than cubé of the same rotenone content, but that the two are equally toxic to others. The apparent superiority may be due to the finer particle size of derris and to its rotenone content being higher than is shown by methods of analysis hitherto used. Rotenone is difficult to extract from many samples of derris, but is readily extracted from cubé. All derris powder sold in the United States is milled there and thereby probably rendered finer than the half of the cubé that is ground abroad. Additional tests with accurately analysed cubé and derris of the same particle size must be made against a number of species of insects before their relative values can be truly ascertained. Under present conditions in the United States, any insecticidal superiority of derris over cubé is more than offset by the difference in prices. Moreover, the principal agricultural insect pests against which rotenone is used, such as the Mexican bean beetle [*Ephilachna varivestis*, Muls.], the pea Aphid [*Macrosiphum onobrychis*, Boy.], and Lepidopterous larvae infesting cabbage, are as readily controlled by cubé as by derris of equal rotenone content.

LAFORGE (F. B.) & MARKWOOD (L. N.). **Organic Insecticides.**—*Annu. Rev. Biochem.* **7** pp. 473–490, 96 refs. Palo Alto, 1938.

This review of the literature comprises a survey of data on the chemistry and, in some cases, the action on insects, etc., of the compounds of the rotenone group found principally in derris and cubé, the pyrethrins, quassin, and nicotine and related alkaloids.

GUI (H. L.). **Spraying and Dusting for Cabbage Worm Control.**—*Bi-m. Bull. Ohio agric. Exp. Sta.* **23** no. 192 pp. 113–118. Wooster, Ohio, 1938.

An account is given of tests carried out in 1934–37 with insecticides against *Pieris* (*Ascia*) *rapae*, L., *Plusia* (*Autographa*) *brassicae*, Riley, and *Plutella maculipennis*, Curt., on cabbage in Ohio [*cf. R.A.E.*, A **24** 91 ; **25** 468 ; **26** 399], from which it is concluded that the best

control is obtained by spraying or dusting with Paris green or derris powder at intervals of 10 days. Paris green dust should be prepared by mixing 1 lb. Paris green with 10 lb. of a diluent such as talc, diatomaceous clay, or lime ; flour is also satisfactory and increases the adhesive qualities of the dust when mixed in equal proportions with other diluents. In sprays, Paris green should be used at the rate of 2 lb. to 50 U.S. gals. water ; a spreader and adhesive is necessary and 2 oz. fish oil is satisfactory. Derris dusts should contain at least 0·5 per cent. rotenone ; 1 lb. derris powder of 4 per cent. rotenone content should be added to 7 lb. flour, talc, diatomaceous clay, dusting gypsum or finely ground tobacco stems. Derris sprays should contain 0·015 per cent. rotenone and should be used with a spreader and adhesive.

[**Papers on Orchard Pests and their Control.**]—*Trans. Ill. hort. Soc. 1937* **71** 444 pp., illus., 5 refs. Springfield, Ill., 1938.

In The Cost of Codling Moth Control (pp. 177–183), W. P. Flint, S. C. Chandler & M. D. Farrar review, chiefly for the period 1931–35, the spray schedules employed in northern, central and southern Illinois for the control of the codling moth [*Cydia pomonella*, L.] on apple and their cost, and discuss the possibility that a greater outlay might be economically profitable, in view of the losses in 1937 with existing applications.

In Effect of non-arsenical Sprays on Apple Trees (pp. 226–227), F. Chatten states that in experiments in 1937 sprays containing lead arsenate gave good control of *C. pomonella* in Illinois; leafhoppers were controlled fairly well by nicotine sprays, but caused serious injury to trees sprayed with lead arsenate. The latter started to drop their fruit 10 days before the others, and had lost over half their leaves by 15th September, while the nicotine-sprayed trees were in full foliage until late November. The higher cost of nicotine was offset by the fact that the fruit did not require washing.

In Results obtained from Nicotine Sprays, 1937 (pp. 228–230), M. P. Reed discusses experiments on the control of *C. pomonella* on apple in south-western Indiana. One area received 8 cover sprays of lead arsenate, two containing oil, and one of these applied about 1st June contained also triethanolamine oleate. The last spray was completed on 29th July. The first two were applied within 7 days, before hatching began, and the third 2 days after. The sprays were applied at the rate of 20 U.S. gals. per tree, except the one containing triethanolamine oleate which was applied at 35 U.S. gals. Another area received 7 nicotine sprays. The first, applied on the day hatching began, the second, applied 5 days later, and the third, fifth and sixth consisted of tank-mix nicotine bentonite, the formula being ½ oz. dreft, 5 lb. bentonite, 1 U.S. pint nicotine sulphate and 1 U.S. qt. soybean oil to 100 U.S. gals. water, mixed in that order; in the seventh, applied on 29th July, the nicotine sulphate was reduced to ½ U.S. pint ; the fourth consisted of ½ per cent. mineral oil with 1 U.S. pint nicotine sulphate to avoid the necessity of washing early maturing varieties to remove bentonite. A 0·6 per cent. oil spray was applied on 1st September to help mask and remove the visible bentonite from the late varieties. The trees in this area received an average of 15 U.S. gals. per tree per application. During May and June, 1,177 moths were caught in 20 bait traps in the nicotine area and 1,147 in 20 in the lead arsenate area, and, during the

rest of the season, the numbers caught were 2,503 and 2,685, respectively. On four varieties, the numbers of larvae per 100 apples in areas sprayed with nicotine were 0·5, 1·2, 6·6 and 17·0, and in areas sprayed with lead arsenate, 1·3, 3·0, 6·5 and 32·2, respectively, and the corresponding numbers of "stings" were 0·6, 1·0, 1·4 and 9·0 and 5·0, 25·8, 22·7 and 76·2. The residue left by the nicotine sprays was more easily and cheaply removed than that left by lead arsenate. The nicotine did not injure the trees, it gave good control of leafhoppers and better early colour than lead arsenate. On all varieties except one, the increased cost of the nicotine was more than offset by the increased control effected. When infestation is heavy, a nicotine and bentonite schedule is more effective and cheaper than lead arsenate in any combination.

In Controlling Codling Moth with heavy Lead Sprays (pp. 231–233), H. Hale discusses the use of an inverted lead arsenate spray [*cf. R.A.E.*, A **25** 419] against *C. pomonella* on apple in eastern Illinois in 1937. Following a calyx spray containing 3 lb. lead arsenate per 100 U.S. gals., 5 applications were made between 12th May and 10th June of a spray consisting of 4 lb. lead arsenate (2 lb. in the fifth cover), 1 U.S. qt. Orthol K (2 U.S. qts. in the two covers at peak of hatch) and approximately 4 oz. soap per 100 U.S. gals.; lime was added at every other application. The infestation was 3 per cent. actual entrances, compared with 30 per cent. in 1936, but fruit and foliage injury was severe, the intensity varying with the variety; the cost of spray materials and application alone exceeded the selling price.

In Results of Peach Insect Control Work in 1937 (pp. 427–432), S. C. Chandler & W. P. Flint state that the percentage infestation of peaches by the oriental fruit moth [*Cydia molesta*, Busck] in southern Illinois in 1937 averaged 12·2 [*cf.* **26** 544], but was somewhat less in central districts. Parasitism of *C. molesta* in the state averaged 28 per cent., 64 per cent. of which was due to *Macrocentrus ancylivorus*, Rohw.; up to 90 per cent. parasitism was recorded in the extreme south. From tests on control in the south of the state, it is concluded that a commercial fixed nicotine spray (Black Leaf 155) gave negligible control of *C. molesta* and the plum curculio [*Conotrachelus nenuphar*, Hbst.], which was contrary to the results obtained in 1936, but analysis showed that in that year the material contained 3 times as much nicotine. Other nicotine sprays were less effective against *C. molesta* than oil-impregnated dusts, which gave about 70 per cent. control when applied at the rate of ½ lb. per tree from one side only, alternating with each application. Dusting early in the season appeared unnecessary, as in one orchard three applications begun 2 weeks before harvest gave good control. An oil-impregnated dust containing 10 per cent. lead arsenate was somewhat inferior to lead arsenate sprays for the control of *Conotrachelus*, although previous tests had shown scarcely any differences.

Larson (A. O.), Brindley (T. A.) & Hinman (F. G.). **Biology of the Pea Weevil in the Pacific Northwest with Suggestions for its Control on Seed Peas.**—*Tech. Bull. U.S. Dep. Agric.* no. 599, 48 pp., 24 figs., 21 refs. Washington, D.C., April 1938.

The following is based on the authors' summary: Investigations in north-western Idaho and western Oregon on *Bruchus pisorum*, L., which is a serious pest of peas in most of the pea-growing territory in the

Pacific Northwest, showed that it can hibernate successfully in almost any protected situation [*cf. R.A.E.*, A **20** 24]. In Idaho, adults survived the winter of 1931–32 under the litter remaining on the surface of pea-fields. They emerged when the spring air temperatures exceeded approximately 70°F., and were attracted to the pea-fields when the peas began to bloom [**22** 92].

The ingestion of pollen was necessary for the production of eggs, and oviposition began 4–14 days after feeding. The maximum number of viable eggs per female was 325. Oviposition took place throughout the pea season except when the air temperature was below 65°F.; the rate decreased late in the summer. Individual plantings were suitable for oviposition for 8–30 days, depending on the time of planting of the peas. In Idaho, the egg, larval, and pupal stages lasted 5–14, 25–56 and 8–27 days, respectively, with averages of 9, 32–43 and 11·5–15 days; and, in Oregon, 6–23, 27–48 and 8–12 days, with averages of 10, 37–38 and 10. The development of a partial second generation was indicated at least in some seasons.

Microdontomerus anthonomi, Crwf., and *Eupteromalus leguminis*, Gah., were found parasitising *B. pisorum* in the field, but parasites and predators appeared to exert little control.

The chief sources of the Bruchids that infest the next year's crop are infested peas that fall from the ripe pods before and during harvest, self-sown peas, seed peas and peas in stored pea hay [*cf.* **19** 578]. Of these, the peas that fall in the field are the most important. Large numbers of Bruchids emerged from peas planted at the normal depth of 3·5 inches. Bruchids in harvested peas can be controlled by fumigation with carbon bisulphide, hydrocyanic acid gas or chloropicrin. Those in peas left in the field after harvest can be controlled effectively only by burning, but this hinders soil conservation. Cage experiments and field tests showed that 0·9–3·6 per cent. of the Bruchids in infested peas could reach the soil surface when buried at a depth of 8 ins., as they would be by a plough [*cf.* **26** 327]. Laboratory and field-plot tests of dusts containing arsenicals, barium fluosilicate and cryolite did not give results that would justify the cost of applying them, though cryolite, which was the most effective, reduced field-plot infestation by about 80 per cent. Aeroplane dusting with calcium arsenate was almost ineffective. Early and clean harvesting and early and complete fumigation of the entire crop harvested are important control measures. In Idaho in 1933, heavy infestations were recorded on all peas planted between 6th April and 15th June, those planted on 25th May being most seriously affected. In 1934, decrease in the damage started after the second planting on 14th March, but was accompanied by a corresponding decrease in the yield. Field-border trap crops of early peas appeared to promise control if the Bruchids attacking them were killed before the peas in the main field bloomed; this was accomplished more effectively by ploughing, followed immediately by the packing of the ploughed soil surface, than by burning.

Elgueta P. (N.). **Un diptero del aji en el norte de Chile.** [A Fly infesting *Capsicum* in the North of Chile.]—*Rev. chil. Hist. nat.* **41** (1937) p. 24. Santiago, 1938.

Lonchaea (*Carpolonchaea*) *pendula*, Bezzi, has been reared in Chile from fruits of *Capsicum annuum* previously injured by larvae of a small moth.

Ronna (A.). **Animaes inimigos da abelha domestica e de seus productos. Fauna das colmeias.** [Animal Pests of the Honey-bee and its Products. The Fauna of Bee-hives.]—*Rev. Dep. Prod. Anim.* **4** no. 4–6 pp. 47–112, 9 figs., 14 pls., 4 pp. refs. Rio de Janeiro, 1937. *Melaloncha ronnai*, **Brgm. 1935 (Phoridae) endoparasita de** *Apis mellifica* **L. (Abelha domestica)**.—*T.c.* pp. 113–126, 14 figs., 7 refs.

In the first of these papers, a list is given of the vertebrate and invertebrate pests of honey-bees, combs, and stored honey and wax, chiefly species that occur in Brazil, together with brief notes on their morphology, the injury they cause, and in some cases, their control.

The more important Arthropods include *Acarapis woodi*, Rennie, which infests the tracheae of the bees, and the wax moth, *Galleria mellonella*, L., which destroys the combs.

The second paper comprises an account of the life-history of *Melaloncha ronnai*, Borgm., the larva, pupa and adults of which are described. This Phorid is an endoparasite of honey-bees in Brazil [*cf. R.A.E.*, A **24** 504], and causes considerable mortality at certain seasons. Females oviposit in the abdominal cavity of the host, where the young larvae develop. About a week after oviposition, the larvae pass into the thorax, and feed on the soft tissues. They pupate after about 3 days, generally within the host, but occasionally, if more than one are present in the same host, outside it. The pupal stage lasts 21–31 days, according to weather, excessive heat or humidity delaying development. The bees are unaffected by the presence of the Phorid in the abdomen, but when it enters the thorax they gradually become paralysed and die. *M. ronnai* is a neotropical species, the native host of which is not known. Measures of control are quoted [*loc. cit.*]. Infestation is most severe in hives situated on low ground sheltered by trees.

Liebermann (J.). **Los predatores vertebrados más importantes de la** *Schistocerca paranensis* **(Burm.) Lat. en la República Argentina y la necesidad de su protección.** [The more important vertebrate Predators of *S. paranensis* in Argentina and the Need for their Protection.]—*Rev. chil. Hist. nat.* **41** (1937) pp. 49–57, 13 refs. Buenos Aires, 1938.

This is a brief summary of the literature, with a list of some of the birds that feed on locusts and grasshoppers in Argentina.

Broekhuizen (S.). **Ziekten en plagen van de champignoncultuur.** [Diseases and Pests of cultivated Mushrooms.]—*Tijdschr. PlZiekt.* **44** pt. 3 pp. 113–140, 7 pls., 62 refs. Wageningen, 1938. (With a Summary in English.)

This paper on pests and diseases of cultivated mushrooms in Holland contains brief sections on insects and mites. Sciarid flies are the chief insect pest, the commonest species being *Sciara* (*Neosciara*) *fenestralis*, Zett. *Sciara* (*Lycoria*) *pusilla*, Mg., and the Phorid, *Megaselia pluri-spinosa*, Lundbeck, are less numerous. Control of these flies is extremely difficult, but infestation by them can be reduced by thorough fermentation of the manure, and applying pyrethrum as a dust on the beds or as a spray. On one occasion, larvae of *Mycophila speyeri*,

Barnes, were found in casing soil ; they were controlled by spraying the beds with salt water. The springtail, *Hypogastrura armata*, Nic., is fairly common, and *Xenylla corticalis*, Börn., a species not previously recorded in Holland, has recently been found on mushrooms. Springtails can be controlled by spraying the beds with a 1 per mille solution of nicotine. Two mites, *Tyrophagus putrescentiae*, Schr. (*Coelognathus dimidiatus*, Herm.) and *Caloglyphus moniezi*, Zkhv. (*mycophagus* (Mégn.), Oudm.), occur, the former being the more harmful. Infestation can be decreased gradually by keeping mushroom houses at a temperature of 50–55°F., which retards the development of the eggs.

Went (J. C.). **Verslag van de onderzoekingen over de iepenziekte, verricht op het phytopathologisch laboratorium " Willie Commelin Scholten " te Baarn, gedurende 1937.** [Report on the Investigations on Elm Disease at the Willie Commelin Scholten Phytopathological Laboratory at Baarn during 1937.]—*Tijdschr. PlZiekt.* **44** pt. 3 pp. 141–154. Wageningen, 1938.

In 1937, experiments were made at Baarn, Holland, on the transmission of *Ceratostomella* (*Graphium*) *ulmi* to elm seedlings of various strains by injection and by *Scolytus scolytus*, F., and *S. multistriatus*, Marsh., the former being the vector chiefly used. The beetles were collected from logs that had been felled in 1936 as traps. One strain (Christine Buisman) of *Ulmus foliacea* did not become infected either by the beetles or by injection. *U. wallichiana* was infected by beetles, and another strain of *U. foliacea* was infected by injection only. *U. glabra* and *U. americana* were infected by both means, and served as controls.

Straňák (F.). **Choroby a poškození kulturních rostlin v Čechách ve vegetačním období 1936–1937.** [Diseases and Injuries of cultivated Plants in Bohemia during the Vegetation Period 1936–37.]—*Ochr. Rost.* **14** no. 55 pp. 1–4. Prague, March 1938. (With a Summary in German.)

Baudyš (E.). **Zpráva o výskutu chorob a škůdců rostlin v hospodářském roce 1936–1937 na Moravě.** [Report on the Occurrence of Diseases and Pests of Plants in Moravia in the agricultural Year 1936–37.]—*T.c.* pp. 4–8. (With a Summary in German.)

Vielwerth (V.). **Zpráva o škodlivých činitelích kulturních rostlin v oblasti západního a středního Slovenska.** [Report on adverse Factors affecting cultivated Plants in western and central Slovakia.]—*T.c.* pp. 8–16. (With a Summary in German.)

Šeda (A.). **Zpráva o škodlivých činitel'och kultúrnych plodín na východ. Slovensku a Podkarpat. Rusi za hospodársky rok 1936–37.** [Report on adverse Factors affecting cultivated Plants in eastern Slovakia and in Carpathian Ruthenia in the agricultural Year 1936–37.]—*T.c.* pp. 16–23. (With a Summary in German.)

In these papers, notes are given on the prevalence in 1936–37 of various diseases and pests (chiefly insects) of cultivated plants in different parts of Czechoslovakia, most of the pests being recorded under their popular names. Those that were injurious in several areas were *Hyponomeuta padellus malinellus*, Zell., on apple, *Nygmia phaeorrhoea*, Don., on various fruit trees, *Pieris brassicae*, L., on cruciferous vegetables, *Meligethes aeneus*, F., on rape, *Aphis papaveris*,

F., on beet, and *Zabrus tenebrioides*, Goeze, and wireworms on cereals. *Sitona lineata*, L., severely infested lucerne in Bohemia, and considerable damage in Moravia was caused by *Euxoa segetum*, Schiff., on beet, *Eucosma ocellana*, Schiff., on apple, and *Coleophora hemerobiella*, Scop., *Aporia crataegi*, L., and *Operophtera* (*Cheimatobia*) *brumata*, L., on various fruit trees.

The pests observed in western and central Slovakia included *Cephus pygmaeus*, L., on wheat, Halticids on seedlings of cabbage and beet, *Tychius quinquepunctatus*, L., on peas, *Coeliodes fuliginosus*, Marsh., attacking the roots of poppies, *Thrips tabaci*, Lind., on tobacco, *Cydia* (*Grapholitha*) *funebrana*, Treit., on plums, and the Rutelid, *Anomala vitis*, F., which seriously injured vines in one locality by feeding on the leaves and young shoots. Important species in eastern Slovakia and Carpathian Ruthenia included *Lema melanopa*, L., on oats and barley, *Atomaria linearis*, Steph., on beet, *Malacosoma neustria*, L., on various fruit trees, *Apiomyia* (*Oligotrophus*) *bergenstammi*, Wachtl, and *Contarinia pyrivora*, Ril., on pears, *Rhagoletis cerasi*, L., on cherries, and *Eriosoma lanigerum*, Hsm., and *Cydia pomonella*, L., on apples.

Kalandra (A.) & Pfeffer (A.). **Důležitější a pozoruhodnější poškození, choroby a škůdci lesních dřevin v letech 1935–1936 v Československu.** [The more important Injuries, Diseases and Pests of Forest Trees in the Years 1935–36 in Czechoslovakia.]—*Ochr. Rost.* **14** no. 55 pp. 24–33, 13 refs. Prague, March 1938. (With a Summary in German.)

The unusual heat and drought that prevailed in Czechoslovakia in 1934 was followed by moderately damp weather in the second half of 1935 and 1936, and insect pests in forests markedly increased in numbers in these years. Notes on their prevalence and local distribution are given by Pfeffer in the second part of this paper. Among the more important species on spruce (*Picea abies*) were the Aphids, *Chermes abietis*, L., and *C.* (*Cnaphalodes*) *strobilobius*, Kalt., various bark-beetles, *Lymantria monacha*, L., and the sawfly, *Pristiphora* (*Nematus*) *abietina*, Christ, an outbreak of which occurred in eastern Moravia in 1935, on trees 45–80 years old over a total area of 370 acres at latitudes of 2,300–3,000 ft. Spruce seedlings in nurseries were attacked by larvae of *Euxoa* (*Agrotis*) *vestigialis*, Rott., and *Euxoa* (*A.*) *segetum*, Schiff. In addition to bark-beetles, pines (*Pinus sylvestris*) were infested by *Rhyacionia* (*Evetria*) *buoliana*, Schiff., *R.* (*E.*) *turionana*, Hb., and *Lyda stellata*, Christ. *Chermes nordmannianae*, Eckstein (*Dreyfusia nüsslini*, Börner) attacked silver fir (*Abies alba*) in many districts in Slovakia, occurring in damp and dry areas and in pure and mixed stands of all ages. In one district, it spread over an area of more than 2,000 acres at altitudes of 1,000–3,000 ft. *Cinara* (*Lachnus*) *laricis*, Wlk., was numerous on larch (*Larix decidua*), and *Dichomeris* (*Nothris*) *marginella*, F., attacked *Juniperus communis*. *Nygmia phaeorrhoea*, Don., was abundant in several districts on oaks and, in association with *Malacosoma neustria*, L., defoliated them over an area of about 10,000 acres in Carpathian Ruthenia in 1936. Young oaks were infested by *Lecanium rufulum*, Ckll. (*pulchrum*, King), which severely injured the seedlings. Dutch elm disease [caused by *Ceratostomella ulmi*] was less prevalent [*cf. R.A.E.*, A **23** 228], but was associated with severe infestation of the elms by *Scolytus scolytus*,

F., *S. multistriatus*, Marsh., and *S. pygmaeus*, F. Ash (*Fraxinus excelsior*) was attacked by *Zeuzera pyrina*, L., and *Stereonychus* (*Cionus*) *fraxini*, DeG. The larvae of the Cerambycid, *Leptidea brevipennis*, Muls., which is an imported pest, damaged the wicker covers of bottles in Prague.

Nejedlý (J.). **Hubení krytonosce světlošpičkého** (*Cryptorrhynchus lapathi*). [The Control of *C. lapathi*.]—*Ochr. Rost.* **14** no. 55 pp. 56–59. Prague, March 1938. (With a Summary in German.)

The weevil, *Cryptorrhynchus lapathi*, L., is a serious pest of willows in Czechoslovakia. The larvae live and pupate deep inside the shoots, and the adults feed chiefly on the sap, which they extract from under the bark of the rods, so that insecticides are ineffective against them. The author believes, therefore, that the best means of control is to flood the plots of willows in the spring, or, failing that, to scorch infested willows in March or April so as to destroy the larvae inside the shoots. Some of the rods may be killed by this treatment, but if the roots are healthy, new shoots will be produced. In experiments in 1936 and 1937, the best results were obtained from scorching by burning straw, which reduced the percentage of infested shoots to 17 and 1·9 as compared with 26·2 and 32·2 per cent., respectively, in controls. Spraying with 10 per cent. tar-distillate emulsion was much less effective. Good control of the adults has been obtained in one locality by allowing poultry to run in willow plots, the plantations having thus been kept free from infestation since 1930.

Šeda (A.). **Postrek jabloní proti červivosti ovocia.** [Spraying against *Cydia pomonella*, L., on Apple.]—*Ochr. Rost.* **14** no. 55 pp. 59–65. Prague, March 1938. (With a Summary in German.)

In some years, *Cydia pomonella*, L., causes serious damage in Czechoslovakia to apples, pears, walnuts and chestnuts. It has one generation a year in some districts and two in others. Experiments on control in apple orchards with proprietary arsenical sprays and Urania green were carried out from 1932 to 1936, but none of them gave a satisfactory reduction of infested fruit and the leaves were often injured by them. The author therefore recommends spraying with lead arsenate; he considers that fairly good control would be obtained by a properly timed calyx spray, but that it would be better to follow this by a cover spray 14 days later and possibly by another in the second half of July.

Blattny [C.] & others. **Krátké zprávy.** [Short Notes.]—*Ochr. Rost.* **14** no. 55 pp. 78–103, 6 figs. Prague, March 1938. (With Summaries in German.)

Brief records are given of observations by a number of workers on insects in various parts of Czechoslovakia.

An outbreak of the spring generation of *Chlorops taeniopus*, Mg., occurred on winter wheat in the Province of Slovakia in 1936, from 30 to 50 per cent. of the plants being attacked in a number of districts. Infested plants were shorter, the yield of grain from them was reduced by 23–66 per cent., and its quality was poor. Infestation was least in varieties of wheat that developed quickly and in wheat

sown early in the autumn. Late sowing of winter wheat has been recommended to safeguard the crop from attack by the autumn generation, but this generation causes considerably less damage than the spring one. In 1937, *Eurygaster maura*, L., and *Aelia acuminata*, L., occurred in small numbers on cereals in Slovakia and in the warmer parts of Bohemia and Moravia. Wheat was preferred, though rye and grasses were also attacked. After harvest, the bugs concentrate and hibernate in the strips dividing the fields and among self-sown cereals.

Ceuthorrhynchus macula-alba, Hbst., is an important pest of poppies in the warmer parts of Czechoslovakia. Brief notes are given on its bionomics [*cf. R.A.E.*, A **24** 704]; in 1937 the overwintered adults appeared in April, and at the end of the season some of them again entered hibernation. Dusting with nicotine sulphate has proved the best means of control, but experiments are being made with trap-strips of poppies sown round old poppy fields.

In the autumn of 1937, up to 90 per cent. of the second-instar larvae of the species of *Lecanium* that attacks plum and other trees in central Bohemia were infested by the fungi, *Cephalosporium lecanii* and *Cordyceps pistillariaeformis* [*cf.* **22** 245], the former predominating.

The use of trap bands on the trunks and branches of apple trees is an effective measure for the control of *Anthonomus pomorum*, L. The bands should be applied at the end of June and removed in February or March of the following year. In experiments in one locality in 1937, 40–100 weevils were caught under each band. Extensive field experiments showed that *Psylla mali*, Schm., on apple is best controlled when the eggs are about to hatch. Tar distillate applied just before the buds burst kills the eggs, and a contact spray, such as 2 per cent. tobacco extract, applied as soon as the buds have opened kills the newly hatched larvae.

Ambros (W.). **Nonnenfalterkontrolle auf biologischer Grundlage.** [Counts of Adult Nun Moths made on a biological Basis.]—*Zbl. ges. Forstw.* 63 pp. 140–151, 4 figs. Vienna, 1937. [Recd. August 1938.]

Investigations in Czechoslovakia in 1937 are described in which the abundance in a forest of the nun moth [*Lymantria monacha*, L.] was estimated by allowing the scent of captive females to attract the males [*cf. R.A.E.*, A **21** 299]. Adults were bred in forest cages from larvae and pupae (usually the female pupae, recognisable by their large size), and the females were confined singly in cardboard boxes, measuring about 4 × 6 inches, with gauze covers. The box was attached to a tree trunk, and strips of paper coated with adhesive were hung round it on the trunk. About 90 females attracted 6,718 males, and the author considers that the method might be developed into a measure for controlling the moth.

Schönwiese (F.). **Einige Beobachtungen über das Auftreten und den Parasiten-Befall der Lärchenminiermotte.** [Some Observations on the Occurrence and Parasitisation of the Larch Case Bearer.]—*Zbl. ges. Forstw.* **63** pp. 312–316, 1 fig. Vienna, 1937. [Recd. August 1938.]

Coleophora laricella, Hb., was very abundant on larch in Upper Styria in 1933–34, and then gradually decreased until it had almost

disappeared in 1937. The infestation extended up to an altitude of about 3,600 ft. There was a good deal of parasitism of the larvae, especially at the lower levels. From May to July three parasites were bred, their numbers from 100 full grown larvae being: 43 of *Chrysocharis* (*Entedon*) *laricinellae*, Ratz. (which was present at all altitudes and was the chief parasite), 26 of *Microdus pumilus*, Ratz., and 6 of *Pteromalus semiclavatus*, Ratz. Parasites bred from material collected from 1934 to 1936 from various parts of Austria and identified by Dr. F. Fahringer included the above and, in addition, *Gelis* (*Pezomachus*) *laricellae*, sp. n., *Hemiteles albipalpus*, Thoms., var. *austriacus*, n., *H. pulchellus*, Grav., *Cirrospilus* (*Entedon*) *pictus* var. *arcuatus*, Först., and *Necremnus leucarthros*, Nees. The last named and *Pteromalus semiclavatus* had not previously been bred from *C. laricella*. Descriptions by Fahringer of the new species and variety are given.

Reinmuth (E.) & Kirchner (H. A.). **Beobachtungen beim Schadauftreten des Goldafters.** [Observations during an Outbreak of the Brown-tail Moth.]—*Z. PflKrankh.* **48** pt. 7 pp. 336–340, 6 figs. Stuttgart, 1938.

A local outbreak of *Nygmia phaeorrhoea*, Don. (*Euproctis chrysorrhoea*, L.) in south-western Mecklenburg began in 1934 and reached its peak in 1936. The larvae occurred in numbers on oaks along a road and, when these were defoliated, migrated to apple and pear trees and almost all other neighbouring plants, including strawberry. The damage in 1936 was severe.

Pape (H.). **Eine Milben-Blattkräuselkrankheit der Aralie.** [A Leaf Crinkle Disease of Aralia caused by Mites.]—*Z. PflKrankh.* **48** pt. 7 pp. 341–346, 5 figs. Stuttgart, 1938.

A description is given of a crinkling of the leaves of *Fatsia japonica* var. *moseri* grown in pots in a nursery in Central Germany. The plants were found to be infested by an apparently undescribed species of *Tarsonemus*, and the crinkle is attributed to the feeding of the mite.

Hofmann (C.). **Freilandstudien über Auftreten, Bionomie, Oekologie und Epidemiologie der Weisstannenlaus** *Dreyfusia* (*Chermes*) *nüsslini* **C. B.** [Field Studies on the Occurrence, Bionomics, Ecology and Epidemiology of the Silver Fir Aphid, *Chermes nordmannianae*, Eckstein.]—*Z. angew. Ent.* **25** pt. pp. 1–55, 22 figs., 3 pp. refs. Berlin, May 1938.

A detailed account is given of observations in 1935–37, including some already noticed [*R.A.E.*, A **25** 726] on the bionomics of *Chermes nordmannianae*, Eckstein (*nüsslini*, Börner) on silver fir (*Abies*) in Bavaria. Historical data on the occurrence of the Aphid in Central Europe are given, and a survey of infestation by it in Germany is compiled from the records.

The dates of appearance of the stages of the sistens, progrediens and sexupara generations varied from year to year, in accordance with climatic conditions, but given stages were always present at certain times, in spite of such variations. Thus, neosistentes were present in September in all three years, but moulting to the second instar became general on 25th October in 1935 and on 15th October in 1937.

Hibernation occurred almost exclusively in the second instar. In general, migration took place only in spring, populations remaining stationary during the remainder of the year. Infestation was not spread by sexuparae, as *Picea orientalis* is normally not present in German forests, but mainly by the neosistentes and neoprogredientes that hatch in May. Observations showed that these forms crawled not only to other parts of the same tree, but also to other trees, and some were carried for considerable distances by wind. Owing to their small numbers, the neosistentes hatching in July and August, and those hatching from the eggs of progredientes in June, scarcely modified the spring distribution of infestation. Details of the distribution of the neosistentes and sistentes on the trees in September and November are given, and the density of the infestations are discussed. Counts of 144 egg-batches deposited by spring sistentes under optimum conditions on the upper branches of young silver firs about 6 ft. high and collected in May 1937, when oviposition was mainly over, gave an average of 233 eggs per female, and a maximum of 491. Spring sistentes on older bark laid distinctly fewer eggs. Progredientes and August sistentes laid only 10–20 eggs.

The main factors responsible for the increase in numbers of *C. nordmannianae* are climate [*cf.* **17** 60] and nutrition. Forestry methods of recent years have replaced stands of mixed fir, beech and spruce by unmixed stands of uniform age. The consequent exposure of the trees is particularly harmful to silver fir and causes physiological changes that favour the Aphid. The selection system, on the other hand, is favourable to the fir and unfavourable to the Aphid. Natural enemies do not exercise any considerable control in Bavaria. Those observed by the author comprised the predacious Coccinellids, *Aphidecta obliterata*, L., and *Exochomus quadripustulatus*, L., and unidentified Syrphids of the genera *Syrphus* and *Pipiza*.

As regards abiotic factors, warm, dry southern and western aspects generally favoured *C. nordmannianae*. In them firs were more severely attacked and succumbed sooner than in the northern situations that are favourable to them. The Aphid appeared resistant to widely varying temperatures, but was susceptible to rainfall, which is a limiting factor in the growth of infestation. The neosistentes were the most affected by humidity and are considered the critical stage epidemiologically. Heavy but brief rains during the period May–October were less harmful than prolonged wet periods, which caused mortalities that ranged up to 90 per cent. Observations showed that an annual rainfall above about 42-44 ins. caused high mortalities.

The present position of control measures is discussed [*cf.* **25** 727]. Further field tests with Detal dust in the autumn of 1937 gave good mortality, but only those individuals directly hit by the dust were killed. Dusting must therefore be carried out carefully with hand-apparatus to reach the undersides of twigs.

STELLWAAG (F.). **Der Massenwechsel des bekreuzten Traubenwicklers *Polychrosis botrana* im Weinbau.** [The Variation in Abundance of *P. botrana* in Viticulture.]—*Z. angew. Ent.* **25** pt. 1 pp. 57–80, 15 graphs, 30 refs. Berlin, May 1938.

The following is based on the author's summary of field observations on the influence of climate on the vine-moths, *Polychrosis botrana*, Schiff., and *Clysia ambiguella*, Hb., made in 1935–37 at Geisenheim

on the Rhine: Adults of both species were active at temperatures between 15 and 25°C. [59–77°F.] and the predominance of one or the other within a temperature range of 14–28°C. [57·2–82·4°F.] at twilight depended on relative humidity. The optimum humidity for *P. botrana* was between 40 and 70 per cent. and that for *C. ambiguella* between 60 and 100 per cent. Flight curves based on data collected in the German vineyard districts showed that the proportions of the two species varied with time and place, and no regular predominance of *P. botrana* over *C. ambiguella* was observed.

The view that *P. botrana* was introduced into Germany from southern Europe is not supported by the evidence. *P. botrana* is sensitive to unfavourable combinations of temperature and humidity, and the increase of both species on vines at the beginning of the 20th century must have been due to a change in the local climatic conditions that obtain in vineyards during the hours of flight.

STEINER (P.). **Hausbockuntersuchungen (2. Mitteilung). Ueber einen wirksamen Feind des Hausbocks, den Hausbuntkäfer *Opilo domesticus* L.** [Investigations on *Hylotrupes bajulus*, L. (2nd Communication). On an effective Enemy of *H. bajulus*, the Clerid *O. domesticus*.]—*Z. angew. Ent.* **25** pt. 1 pp. 81–91, 6 figs., 13 refs. Berlin, May 1938.

It has been observed in Germany that structural timber in attics showing traces of mass infestation by *Hylotrupes bajulus*, L., often contains a very small number of larvae though much sound wood remains. Changes in microclimate are doubtless responsible in many cases for such reductions in infestation, but the influence of natural enemies should not be neglected. Of these, the most important is the predacious Clerid, *Opilo domesticus*, Sturm [*cf. R.A.E.*, A **17** 463], and the presence of only 342 larvae of the Cerambycid in two apparently heavily infested beams is attributed to the 37 larvae of *O. domesticus* that were also found. The way in which the Clerid larva attacks its prey is described. *Opilo* spp. are polyphagous, and in breeding experiments, larvae of *O. domesticus* fed on *Haematopinus suis*, L., and larvae of *Ephestia kuehniella*, Zell., and young adults on adults of *Sitodrepa panicea*, L. The beginning of the prepupal stage is characterised by restless wandering of the larvae, which readily pupated in cork. The larvae frequently devoured the pupae and gnawed wood, so that they are not entirely harmless. The prepupal and pupal stages lasted about 2–3 weeks and 18 days, respectively, at about 20°C. [68°F.]. One adult survived for about 10 weeks.

WATZL (O.). **Entwicklungsdaten, Bekämpfbarkeit und Schadensbedeutung der San-José-Schildlaus (*Aspidiotus perniciosus* Comst.).** [Data on Development, Susceptibility to Control and Degree of Harmfulness of the San José Scale.]—*Z. angew. Ent.* **25** pt. 1 pp. 92–100, 15 refs. Berlin, May 1938.

This paper comprises a summary of five years' investigations on *Aspidiotus perniciosus*, Comst., in Austria, where it infests all kinds of fruit trees and a variety of other plants. The occurrence of the various stages is recorded for the successive months of the year. Experiments with 22 winter sprays (chiefly proprietary tar distillates and mineral

oil emulsions) were made near Vienna in five winters beginning 1932–33. Regular spraying reduced the numbers of the Coccid to a level at which it was no longer harmful, and individual plants could be completely freed from infestation. Mineral oil is less likely to injure the trees than tar distillate if the application has to be made late in the winter. As the sprays can only be used at concentrations that seldom completely eradicate the infestation, it is advised that a supplementary spray of lime-sulphur at winter strength be applied shortly before the buds open. Tests in July 1933 with summer sprays of soft soap, tobacco extract, or both gave poor results; summer oils were more promising, but would be too expensive for practical use. Experiments were also made on fumigation with hydrocyanic acid gas in tents, boxes, and a brick chamber. All the scales on small fruit trees could usually be killed by fumigation for an hour with 0·3–0·5 volumes per cent. of hydrocyanic acid gas released from Calcid tablets or Zyklon. Plants in leaf were only slightly injured if fumigated by night at 15–20°C. [59–68°F.]. Complete control without injury was obtained by fumigating dormant plants in the chamber with 0·5 volumes per cent. for 1 hour at 11°C. [51·8°F.].

Aspidiotus perniciosus is not considered a very serious pest in Austria. It has only two generations a year and does not increase rapidly, while severe winter frosts kill all stages except the first-instar larvae. Heavy infestation has only been observed in the districts with a mild climate, and even severely infested plants survive for years and die only if the injury is aggravated by damage due to frost.

SEITNER (M.). **Die Lebensweise von** *Evetria turionana* **Hb. var.** *mughiana* **Zell. und Beobachtungen über andere an der Zirbe lebende Kleinschmetterlinge.** [The Life-history of *Rhyacionia turionana* var. *mughiana*, Zell., and Observations on other Microlepidoptera living on *Pinus cembra*.]—*Z. angew. Ent.* **25** pt. 1 pp. 101–110, 6 figs. Berlin, May 1938.

This paper has been prepared by E. Schimitschek from notes left by the late Professor Seitner.

Rhyacionia (*Evetria*) *turionana* var. *mughiana*, Zell., is an Alpine variety that in the Austrian Alps occurs in *Pinus mugo* and *P. cembra*. The larvae are described and a detailed account is given of their biology. The life-cycle lasts two years, and the moths occur from May to August, being most abundant in June and July, No observations were made on oviposition, but the egg stage appeared to last 2 weeks. The larvae that hatched early in the season bored into young shoots of the current year's growth, often starting at the base and proceeding towards the bud. This resulted in shortening of the shoot and the needles. Those that hatched later (July) always bored into the distal ends of the shoots about half an inch below the terminal buds, causing exudation of resin and red discoloration of the tip needles, but no shortening. The larvae overwintered in the shoots and entered fresh ones during the following season. Some pupated in these shoots during the second winter and gave rise to adults in spring, but those that were not full-fed left their winter quarters again, wandered for a time and then, at the beginning of June, bored into shoots about an inch below the terminal bud and pupated, the adults appearing after about 2 weeks. Of the larvae collected, 33 per cent. pupated in winter.

Other Microlepidoptera observed on *Pinus cembra* included *Cydia* (*Laspeyresia*) *coniferana*, Ratz., which also appeared to have a two-year life-cycle, *Tortrix* (*Cacoecia*) *piceana*, L., *Enarmonia* (*Semasia*) *diniana*, Gn., *Ocnerostoma piniariella*, Zell. (*copiosella*, Frey), *Borkhausenia stipella*, L., and *Solenobia pineti*, Zell.

SCHIMITSCHEK (E.). **M. Seitners Bearbeitung der Insektenschädlinge der Zirbe in biozönotischer Darstellung.** [M. Seitner's biocoenotic Study of the Insect Pests of *Pinus cembra*.]—*Z. angew. Ent.* **25** pt. 1 pp. 111–124, 18 figs., 6 refs. Berlin, May 1938.

From notes left by the late Prof. Seitner, the author compiles a list of 67 insects, 45 of which are Coleoptera, that attack *Pinus cembra* in Austria, giving the localities in which they occurred and in several cases their natural enemies.

ÖRÖSI-PÁL (Z.). **Afterskorpione (Chelonethi) in der Wohnung der Honigbiene. Eine Zusammenfassung und eigene Untersuchungen.** [Pseudoscorpions in the Bee-hive. A Compilation and original Investigations.]—*Z. angew. Ent.* **25** pt. 1 pp. 142–150, 6 figs., 28 refs. Berlin, May 1938.

Instances are cited from the literature of the occurrence of pseudoscorpions in beehives ; the species most often recorded is *Chelifer cancroides*, L. [*cf. R.A.E.*, A **10** 491]. In Berlin in 1937, the author observed *C. cancroides* preying on larvae of the wax moth, *Galleria mellonella*, L., that were less than 1 cm. long.

ZILLIG (H.). **Der Eichenprozessionsspinner** (*Thaumetopoea processionea* **L.**) **als Gelegenheitsschädling an Weinreben.** [The Oak Processionary as an occasional Pest in Vineyards.]—*Anz. Schädlingsk.* **14** pt. 6 pp. 61–62, 2 figs. Berlin, 15th June 1938.

In 1936, larvae of *Thaumetopoea processionea*, L., migrated from defoliated oak coppices to vineyards in a district in the Moselle region, Germany. Similar migration was observed in several localities in the region in 1937, the larvae having also attacked spruce after defoliating the oaks. The growth of the vines was considerably checked by their feeding on the leaves.

The addition of 0·4 per cent. calcium arsenate or 0·2 per cent. Paris green to the customary post-blossom Bordeaux spray destroyed many of the larvae on the vines. No immediate effect was given by sprays containing 0·15 per cent. crude nicotine or 0·5 per cent. pyrethrum extract, but on the next day mortality was evident ; it was greater with nicotine than with pyrethrum. Foresters were advised to dust the oaks with an arsenical.

GÄBLER (H.). *Rhynchites nanus* **Payk.** (*planirostris* **F.**) **als Triebschädiger der Weide.** [*R. nanus* injurious to Willow Shoots.]—*Anz. Schädlingsk.* **14** pt. 6 pp. 62–64, 1 fig., 5 refs. Berlin, 15th June 1938.

Rhynchites nanus, Payk., caused considerable damage to willows, principally *Salix caprea*, near Tharandt, in Saxony, in the period 1934-37. The weevils fed on the leaves of the shoot tips and bored into the young shoots, and females oviposited in the withered tips,

depositing one egg in each. In the laboratory, adults paired at the beginning of June and females oviposited in shoots of willow in the middle of the month. The egg stage lasted about 10 days. Young larvae remained in the shoots, which are not abandoned until they fall to the ground. References in the literature to feeding by *R. nanus* on economic plants are given, and the damage it causes is compared with that caused by *R. tomentosus*, Gyll., which is much commoner on willow.

FARSKÝ (O.). **Nonnenkontroll- und Vorbeugungsmethode nach Professor Forst.-Ing. Ant. Dyk.** [Prof. Dyk's Method for Estimation of Abundance of and for Prevention of Attack by the Nun Moths.]—*Anz. Schädlingsk.* **14** pts. 5–6 pp. 52–56, 65–67, 3 figs. Berlin, 15th May & 15th June 1938.

The author reviews from the literature the practical method devised by Dyk for making use of the scent of females of the nun moth [*Lymantria monacha*, L.] to attract the males, reproduces the results of the workers who have used it [*cf. R.A.E.*, A **26** 659, etc.] and suggests that similar tests should be made with similar Lepidoptera. Dyk found it possible to preserve the scent on a wad of cotton-wool by storing it in a sealed bottle after a female had been kept on it from the time of emergence until just before oviposition began.

SOKANOWSKY (B.). **Zur Bekämpfung der Spinnmilbe *Tetranychus althaeae* v. Haenst. in Gehölzen der Moskauer Anlagen.** [The Control of the Spinning Mite, *T. telarius*, L., in Woods in the Parks of Moscow.]—*Anz. Schädlingsk.* **14** pt. 6 pp. 68–69. Berlin, 15th June 1938.

Tetranychus telarius, L. (*althaeae*, v. Hanst.) caused spotting or even total discoloration of the leaves of trees in the parks of Moscow. In the autumn of 1932, adhesive bands were placed on several trees, and it was ascertained that most of the mites descend the trunks in autumn in order to hibernate in the ground. Many thousands were caught on the bands, and even greater numbers were found assembled in masses immediately above them and were destroyed by spraying with a mineral oil emulsion, which gave a mortality of 85–90 per cent. In spring, when the snow melts, new bands should be fixed and the mites assembled beneath them should be destroyed in the same way. The bands should be $2\frac{1}{2}$ ft. from the ground in autumn and 6–7 ft. in spring.

WIRTH (H.). **Vergleichende Versuche zur Prüfung von Raupenleimen.** [Comparative Experiments for testing Banding Adhesives.]—*NachrBl. dtsch. PflSchDienst* **18** no. 6 p. 52, 1 fig. Berlin, June 1938.

A description is given of methods used to test the qualities of 6 proprietary banding adhesives. The temperature at which the adhesive begins to flow was ascertained by smearing 0·5 gm. on the bulb of a thermometer that was held upright against a board covered with the paper used for adhesive bands. The heat from a portable electric radiator was directed at the thermometer, the position of the radiator being adjusted to raise the temperature at the rate of 1°C.

[1·8°F.] a minute. The test was stopped when the flow reached a mark 1 cm. below the thermometer. The temperatures obtained are recorded; they are from 4 to 9°C. [7·2–16·2°F.] lower than those at which the adhesives dripped. For testing viscosity, 2·5 gm. of the adhesive was evenly spread on an area, 5×10 cm., on a glass plate. A glass tube, 1 metre long and 1 cm. in diameter, was fixed at a slant of 45 degrees, and the glass plate was placed 1 cm. from the lower end of the tube and at right angles to it, the end of the tube being opposite the centre of the patch of adhesive. Twenty poppy seeds of uniform size were dropped through the tube on to the adhesive, and the number that adhered served as the measure of viscosity. When freshly spread, all six bands retained all the seeds. The glass plates with the patches of adhesive were then exposed outdoors from 19th February to 19th March, and the test was repeated, the number of seeds retained varying from 1 to 20.

HOWARD (Sir A.). **Insects and Fungi in Agriculture.**—*Emp. Cott. Gr. Rev.* **15** no. 3 pp. 215–223, 7 refs. London, July 1938.

The author adduces further evidence in support of his theory that infestation of crops by insects and fungi is due to the crops being grown under unsuitable conditions [*R.A.E.*, A **24** 600] and criticises the view that healthier plants of cotton or other crops are more infested by insect pests [**25** 263]. He states that crops of *Hibiscus cannabinus* and cotton in the Punjab frequently grow well at first, but are very susceptible to insect attack during the maturation of the seed, owing to the gradual development of a colloidal condition of the soil that interferes with aeration and drainage. The invasions of locusts in central and north-western India always start from the deserts in which the eggs are laid, and cause the maximum damage on irrigated crops during the hot weather, but the swarms rapidly disappear soon after the rains begin and normally grown vegetation is available. An experiment in eastern England, which was started in December 1935, indicated that crops show a greater resistance to insect and fungous pests when humus is suitably applied to the soil.

GOLDING (F. D.). **Notes on the Insect Pests of Cotton in Nigeria.**—*Emp. Cott. Gr. Rev.* **15** no. 3 pp. 224–227, 6 refs. London, July 1938.

Research since 1922 on insect pests of cotton in Nigeria indicated that Allen cotton (*Gossypium hirsutum*) was unsuitable for areas to the south of 9°N. Lat. because of its susceptibility to infestation by *Dysdercus* spp. and its unsuitability for intercropping. In the southern provinces, the growing of this variety was discontinued in 1926, and it was replaced by an improved strain of Ishan (*G. barbadense*). Since then, infestations by *Dysdercus* spp. have not been extensive (although the annual variation has been considerable), except on small patches of introduced cotton grown in the last 8 years and, by *D. superstitiosus*, F., on certain early-flowering Ishan × Sea Island hybrids in a selection plot in 1935–36. These hybrids were severely attacked by *Empoasca facialis*, Jac., but the improved strain continued to resist this Jassid and also *Bemisia goldingi*, Corb., the Aleurodid vector of leaf-curl. By 1931, it was apparent that the Capsid, *Helopeltis*

bergrothi, Reut., caused more damage to the Ishan crop in some seasons than any other insect pest ; its distribution is sporadic and the infestation varies greatly in intensity from year to year. In 1924–25, larvae of the Eumolpid, *Syagrus calcaratus*, F., caused considerable damage to the roots of early-sown Allen cotton at Ibadan ; native cottons, which were also attacked, showed greater power of recovery [*R.A.E.*, A **14** 323]. In 1937–38, *S. calcaratus* damaged the root systems of many Ishan and hybrid plants at Ibadan, and almost certainly reduced the yield. Plants on native farms seldom showed wilt or excessive leaf-shedding, and this pest is probably localised rather than general.

Although *D. superstitiosus* is widespread in the northern provinces, it is not a major pest of *G. hirsutum* there, probably on account of the extreme atmospheric aridity in late October and November, when green bolls are most numerous. During an investigation in the centre of the area at the beginning of 1938, 80 live pupae and 465 empty cocoons of *Earias* were taken from 844 cotton plants. A larva of *Diparopsis castanea*, Hmps., was found in an earthern cell, and 15 live pupae, possibly of this species, were collected from the soil in cotton fields. In August and September 1937, *Sylepta derogata*, F., was unusually numerous in areas of early-sown cotton, probably because the length of the dead season had been reduced. The abundance of Jassids in some seasons has necessitated the growing of resistant strains ; *Empoasca facialis* caused considerable damage in one season when a non-resistant strain was grown on a large scale. J. K. Mayo considers that leaf-curl transmitted by *Bemisia* is more important than stainers in the northern part of the area, and observed that Jassid-resistant strains of cotton were not invariably resistant to leaf-curl. *Helopeltis* has not yet been recorded from this region.

In the Ilorin and Benue provinces, bollworm and stainer infestation is usually less extensive than in the southern provinces, but Pentatomids, which are seldom found on cotton in the latter, cause considerable damage to green bolls in some seasons. *Platyedra gossypiella*, Saund., does not occur in Nigeria, and the only record of the Buprestid, *Sphenoptera gossypii*, Cotes, there was in 1930, when the larvae were found tunnelling in the roots of cotton in Ilorin Province, killing a number of plants.

Fukai (K.). **Studies on the Possibility of Life of the Formosan Melon Fly in Japan.** [*In Japanese.*]—*Nojikairyo-Shiryo* no. 134 pp. 147–213, 8 pls. Tokyo, 1938.

As *Dacus* (*Chaetodacus*) *cucurbitae*, Coq., which is a serious pest of cucurbits in Formosa, does not occur in Japan, investigations were made in northern Kyushu with material imported from Formosa in 1928 to determine whether it could survive there. In the laboratory, 8 or 9 generations occurred in a year, the duration of the life-cycle varying from 21 to 179 days. Adults survived for over a year at room temperature when supplied with fruit juices, but for only 3–5 days when given water only. They became inactive at 9–8°C. [48·2–46·4°F.], but many survived exposure to temperatures between −4·6 and 5°C. [23·72–41°F.] for 128 hours out-of-doors in winter. The eggs hatched in 21–22 hours in summer, and the larval stage lasted 5·1 days in summer, 7–10 in spring and autumn, and 19–22 in winter experiments in which the larvae were obtained from eggs

laid in a heated cage. The larvae developed in fruits of a wide range of plants, including egg-plant, peach, pear, strawberry, apple and *Citrus*, and full-fed larvae pupated 2–6 hours after entering the soil. The pupal stage lasted 7–10 days from July to September and 55–56 in December–January, but only 17–44 per cent. of the individuals pupating then gave rise to adults. Some larvae in fruits survived submersion in sea-water for 72 hours, and developed normally, and some pupae survived similar submersion for 36 hours.

The author concludes that *D. cucurbitae* would be able to establish itself under natural conditions in Japan, and emphasises the importance of measures to prevent its importation from Formosa [*cf. R.A.E.*, A **25** 228].

Harukawa (C.) & Kumashiro (S.). **On** *Sitotroga cerealella* **Oliv.** [*In Japanese.*]—*Nogakukenkyu* **29** pp. 1–44. Kurashiki, 1938.

Investigations on *Sitotroga cerealella*, Oli., at Kurashiki showed that whereas only 0·26 per cent. of wheat grains were infested by it soon after harvest, 82 per cent. were injured at the beginning of September. In wheat of which the moisture content was 8 per cent. very few larvae matured and none of them gave rise to an adult, but in wheat of which the moisture content was 12 per cent. or more, up to 7 per cent. of the larvae reached the adult stage. Infestation of stored wheat was most severe near the surface and considerably less at a depth of 6 ins. Wheat was more severely injured when stored loosely in bags or boxes.

About 40–80 per cent. of larvae that hatched as early as late May, and most of those that hatched in mid-September, hibernated. It appears that all the eggs and almost all the pupae die during the winter; and although females emerged even in December and January, they did not survive until April, when oviposition begins. The overwintered larvae pupated from late April or May, when the average temperature was above 14–15°C. [57·2–59°F.]. There are usually 4 generations a year, the first, second and third being completed in about 40, 30 and 30 days, respectively. The egg stage varied from 4 days in early August to 10 in early June, the larval stage from 15 days in July and early August to 38 days in early June, and the pupal stage from 4 days in late July to 11 days in early July.

Adult longevity increased with a decrease in temperature to 10°C. [50°F.] and then decreased. Females survived for 9, 30 and 53 days in mid-July, mid-October and mid-November, respectively. The preoviposition period averaged 0·7 days in mid-July and 9 days in early November, and females deposited about 130 eggs on an average, the maximum recorded being 202. Some females oviposited at temperatures as high as 36·5°C. [97·7°F.], but none did so at 10°C. Eggs developed at temperatures between 15 and 36·5°C., and hatched in 3·4 days at 35°C. [95°F.] but did not survive exposure to 10°C. for 80–90 days. They were only very slightly affected by atmospheric humidity, over 80 per cent. hatching at a relative humidity as low as 32 per cent. The larval stage, which was rarely completed at 15°C., lasted 10 and about 16 days at 30 and 20°C. [86 and 68°F.], respectively, and the pupal stage lasted 7 and 40 days at 35 and 15°C., pupae developing between the extremes of 12°C. [53·6°F.] and 36·5°C. The percentage of adult emergence was highest at 20°C.

KAMIYA (K.). **Relation of the Occurrence of the parasitic Wasps of *Dendrolimus spectabilis* Butl. to environmental Conditions.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **10** no. 3–4 pp. 85–89. Tokyo, July 1938.

Of 3,858 larvae of *Dendrolimus spectabilis*, Btlr., collected in unmixed pine forests in Japan in 1935 and 1937, 26·24 per cent. were parasitised; 93·39 per cent. of the parasites were Diptera, 1·87 Hymenoptera and 4·74 fungi. The corresponding percentages for 775 larvae taken in mixed forests in the same years were 51·74, 35·9, 56·85, and 7·25. In unmixed pine forests only a few species of parasitic Hymenoptera occur, including *Brachymeria obscurata*, Wlk., *Pimpla pluto*, Ashm., and *Stenaraeoides octocinctus*, Ashm., while in mixed forests they are more numerous and include, in addition, *Pteromalus matsuyadorii*, Mats., *Monodontomerus dentipes*, Boh., *Pimpla disparis*, Vier., *P.* (*Itoplectis*) *attaci*, Haberm., and *P.* (*Iseropus*) *epicnapterus*, Uch.

MISHIMA (R.). **History of Outbreaks of Insect Pests in Nara Prefecture.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **10** no. 3–4 pp. 89–94. Tokyo, July 1938.

An account is given of the history of outbreaks of a number of insect pests in Nara Prefecture. The insects include *Bruchus pisorum*, L., which was apparently introduced into the Prefecture about 1904 and causes serious damage to peas, and the rice borer, *Chilo simplex*, Btlr., which seems to have been abundant at intervals of 6 years, as judged from the numbers of adults taken in light-traps.

YAMAZAKI (T.). **On some Habits of *Cylas formicarius* Fab.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **10** no. 3–4 pp. 105–108. Tokyo, July 1938.

Observations on the habits of *Cylas formicarius*, F., in the Loochoo Islands, where this weevil is a serious pest of sweet potato, showed that females do not oviposit on the leaves, stalks or dried cuttings of sweet potato or morning glory [*Ipomoea*], although the adults live among the dried cuttings.

SUENAGA (H.). **On *Acrocercops* sp., a Miner of Chestnut Trees. (Preliminary Report)** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **10** no. 3–4 pp. 108–109. Tokyo, July 1938.

The larvae of an unidentified species of *Acrocercops* cause considerable damage to chestnut trees in Saitama Prefecture by mining under the bark of young shoots. There are 2–3 generations a year, the adults emerging in May, July and late August, and the winter is passed by mature larvae in cocoons in the mines. The larval stage lasted 20–30 days in spring and summer, and over 8 months in the hibernating generation. The pupal stage lasted 12–20 days. Some varieties of chestnut are preferred, and a species of oak is also attacked.

HAMA (T.). **On the Percentage of Parasitism of *Trichogramma japonicum* Ashm., a Parasite of the Eggs of *Chilo simplex* Butl., in the Nurseries of the Rice Plant.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **10** no. 3–4 pp. 109–111. Tokyo, July 1938.

In 1937, *Trichogramma japonicum*, Ashm., parasitised an average of 30·2 per cent. of the egg-masses and 15·4 per cent. of the eggs of

Chilo simplex, Btlr., on rice seedlings in Kanagawa Prefecture. These percentages, though nearly the same as in 1936, were lower than usual [*cf. R.A.E.*, A **24** 699], partly owing to the abundance of the host in that year; 26·5 per cent. of the parasites did not emerge. Females were 3 times as numerous as males.

HAMA (T.). **On the Cold Storage of the Eggs of *Ephestia cautella* Walk. and *Trichogramma japonicum* Ashm.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **10** no. 3–4 pp. 111–114. Tokyo, July 1938.

The results are given of further investigations in Tokyo on the cold storage of eggs of *Ephestia cautella*, Wlk., required for breeding *Trichogramma japonicum*, Ashm. [*cf. R.A.E.*, A **25** 746]. When the host eggs had been kept at 5–10°C. [41–50°F.] and 60 per cent. relative humidity, the percentages of parasitism and parasite emergence were high, but eggs that had been kept in cold storage at a lower relative humidity were unsuitable for parasitism. The fecundity of the female parasites reared from the eggs was not affected by the humidity at which the latter had been kept, but decreased when they had been kept in cold for long periods. The progeny of female parasites reared in eggs that had been kept in cold storage was quite normal.

YUASA (H.). **Studies on Cecidomyiids infesting Wheat. 3.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **10** no. 3–4 pp. 114–116. Tokyo, July 1938.

In this third paper in a series on Cecidomyiids attacking wheat in Japan [*cf. R.A.E.*, A **24** 700; **25** 746], the author states that in 1937 adults of *Sitodiplosis mosellana*, Géh., emerged from 22nd April to 17th May in the laboratory at Tokyo and that most of them emerged in May in wheat-fields in Tochigi Prefecture. Although it occurred throughout the day, emergence was most intense in the early morning and evening. Parasites recorded from *S. mosellana* comprised *Pirene* sp., *Platygaster* sp., and *Ceraphron* sp., but the last may be a hyperparasite. An undetermined Cecidomyiid infesting wheat, possibly a species of *Contarinia*, resembles *S. mosellana* in the emergence of its adults and is parasitised by a species of *Inostemma*. *Haplothrips aculeatus*, F., appeared to feed on the eggs.

SHIBUYA (M.). **Local Percentages of Parasitism of *Trichogramma japonicum* Ash. in the first Adult Emergence Period of *Chilo simplex* Butl.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **10** no. 3–4 p. 126. Tokyo, July 1938.

Counts during the period 1934–36 of the numbers of first-generation eggs of *Chilo simplex*, Btlr., on rice parasitised by *Trichogramma japonicum*, Ashm., in various localities in Japan showed that the percentage parasitism was lowest in Niigata Prefecture, where only 1·3 per cent. of the egg-masses and 0·2 per cent. of the eggs were parasitised, and highest in Kochi Prefecture, where these figures were 90·9 and 77·6, respectively. The percentages of eggs attacked were less than 10 in localities on the eastern coast of northern Honshu and on the Sea of Japan, and more than 30 in Yamaguchi, Nagasaki and Kochi Prefectures.

KAWADA (T.). **Effects of Infestation by** *Chilo simplex* **Butl. in the first Adult Emergence Period on the Shooting and Amount of Crop of the Rice Plant.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **10** no. 3–4 p. 116. Tokyo, July 1938.

In experiments in Japan on the effect of early infestation of rice by *Chilo simplex*, Btlr., the number of grains per ear and the number of mature grains per ear were greater in infested than in uninfested plots, but the percentage of mature grains per ear was less.

IWASA (T.) & MATSUMOTO (K.). **On** *Spilonota lechriaspis* **Meyr.** [In *Japanese.*]—*Oyo-Dobuts. Zasshi* **10** no. 3–4 pp. 131–133. Tokyo, July 1938.

Eucosma (*Spilonota*) *lechriaspis*, Meyr., all stages of which are described, causes considerable damage to apple in Hyogo Prefecture, where it also attacks pear and related trees. It has not been recorded in other parts of Japan and was probably imported from Korea. Its bionomics in the two countries are similar [*cf. R.A.E.*, A **25** 671], but it has 2–3 generations a year in Japan. The overwintered larvae begin to feed in early April, and the adults emerge from late May to early June and from early July to early October. An unidentified Ichneumonid parasitises the larvae.

YATOMI (K.) & YAMASHITA (S.). **On the Effect of Temperature and Humidity upon the hatching of the Eggs of** *Ephestia cautella* **Walk. (Preliminary Report.)** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **10** no. 3–4 pp. 133–136, 1 fig. Tokyo, July 1938.

The eggs of *Ephestia cautella*, Wlk. (which are used for breeding *Trichogramma japonicum*, Ashm., in Japan) hatch at temperatures between about 10 and 38°C. [50–100·4°F.], 24–25°C. [75·2–77°F.] being the optimum. Relative humidity has less effect on hatching than temperature, but the optimum appears to be 80–90 per cent.

YATOMI (K.) & YAMADA (S.). **Supplementary Notes on** *Amphimermis zuimushi* **Kabur. et Imam.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **10** no. 3–4 pp. 136–139, 1 fig. Tokyo, July 1938.

The Nematode, *Amphimermis zuimushi*, Kabur. & Imam., occurs in Shizuoka Prefecture and probably in Shiga Prefecture, parasitising high percentages of the second-generation larvae of *Chilo simplex*, Btlr., on rice. No first-generation larvae are attacked, probably owing to the late development of the parasite [*cf. R.A.E.*, A **21** 15; **22** 311].

ISHII (T.). **On the Japanese Species and the Biology of** *Trichogramma*. **(Preliminary Report.)** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **10** no. 3–4 pp. 139–141. Tokyo, July 1938.

Of the five species of egg-parasites of the genus *Trichogramma* that occur in Japan, *T. japonicum*, Ashm., is parasitic on rice-borers and *Naranga aenescens*, Moore, *T. evanescens*, Westw., on Noctuids, *T. australicum*, Gir., and an unidentified species on *Chilo simplex*, Btlr., and *T. dendrolimi*, Mats. (*dendrolimusi*, Mats.) on *Dendrolimus spectabilis*,

Btlr., Tortricids, *Cirphis unipuncta*, Haw., and *Cocytodes coerulea.*, Gn. *T. evanescens* occurs in fields, *T. dendrolimi* in trees, and the other three species in marshes.

Monzen (K.). **On** *Dacus dorsalis* **Hendel in the Bonin Islands.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **10** no. 3–4 pp. 143–145. Tokyo, July 1938.

Dacus ferrugineus var. *dorsalis*, Hend., attacks peach, mango and guava in the Bonin Islands, into which it was apparently introduced from Saipan (Marianna Islands) in 1932. Females have been observed to oviposit on fruits in shops. The flies are attracted by amyl alcohol, and a bait of a 10 per cent. sugar solution containing 5 per cent. amyl alcohol is recommended against them.

Kuroda (S.). **On the Hosts of** *Trichogramma japonicum* **Ashm.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **10** no. 3–4 pp. 149–151. Tokyo, July 1938.

In an experiment in which the eggs of various moths were exposed in rice fields in Japan to test the host selection of *Trichogramma japonicum*, Ashm., adults of this parasite emerged from the eggs of 16 species in 5 families.

Kariya (S.). **On the Relation of the Food Plants of** *Dendrolimus spectabilis* **Butl. to the Percentage of Adult Emergence. (Preliminary Report.)** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **10** no. 3–4 pp. 166–167. Tokyo, July 1938.

Larvae of *Dendrolimus spectabilis*, Btlr., are very injurious to pines in southern Manchuria and prefer *Pinus tabulaeformis*. In experiments, over 30 per cent. of the larvae gave rise to adults when fed on *P. tabulaeformis*, *P. bungeana*, *P. densiflora*, *P. sylvestris* and *P. nigra*, and less than 30 per cent. did so when fed upon *P. koraiensis*, *P. ponderosa*, *P. strobus*, *P. banksiana* and *Larix kaempferi*. Although the larvae fed slightly on *P. rigida*, *P. excelsa*, *Abies* spp. and *Picea* spp., none gave rise to an adult.

Kumashiro (S.). **On the Insect Pests of** *Juncus effusus* **L. var.** *decipiens*, **1 & 2.** [*In Japanese.*]—*J. Plant Prot.* **25** nos. 6–7 pp. 450–455, 543–547. Tokyo, June–July 1938.

Brief notes are given on the bionomics in Japan of the sawflies, *Tomostethus juncivorus*, Rohw. [*cf. R.A.E.*, A **18** 674] and *Dolerus harukawai*, Wtstn. [**18** 614], *Oxya vicina*, Brunner [**24** 123], an unidentified Gelechiid, *Plusia* (*Phytometra*) *festata*, Graes., *Cirphis unipuncta*, Haw., and *Meliana flammea* var. *stenoptera*, Staud., all of which attack *Juncus effusus decipiens*, a rush that is used for making mats, though the last three only do so occasionally. The larvae of the Gelechiid, which has three generations a year, bore the leaf sheaths, causing the distal parts to turn yellowish brown and retarding the growth of the plants.

Kurosawa (M.). **Notes on three unrecorded Thrips from Greenhouses in Nippon.** [*In Japanese.*]—*Kontyû* **12** no. 4 pp. 121–129, 5 figs. Tokyo, July 1938.

Anaphothrips orchidii, Moult., on the leaves of *Cyclamen europaeum*, *Taeniothrips xanthius*, Williams, on orchids (*Cattleya*), and *Scopaeothrips unicolor*, Hood, on *Opuntia*, have recently been observed in greenhouses in Japan. These thrips are briefly described.

Kono (H.) & Sawamoto (T.). **On the Food of the Larvae of Butterflies in Hokkaido.** [*In Japanese.*]—*Kontyû* **12** no. 4 pp. 140–145. Tokyo, July 1938.

A list is given of 33 Rhopalocera that occur in Hokkaido, with the food-plants of their larvae. They include *Papilio machaon*, L., on *Cryptotaenia japonica* and carrots; *Aporia crataegi adherbal*, Fruhst., on apple; *Colias hyale poliographus*, Motsch., on soy beans and other leguminous plants; *Pyrameis cardui japonica*, Stichel, on *Arctium lappa*; *Vanessa io geisha*, Stichel, on hops; and *Sasakia charonda*, Hew., on *Celtis sininsis*. *Castalius hamada jezoensis*, Mats., is predacious on *Doraphis populi*, Mats. et Hori, on poplar (*Populus*).

Takahashi (S.). **Damage by the Larvae of *Eucosma schistaceana* Snellen in the Sugar-cane Stalks for planting and the Percentage of their Emergence as Adults.** [*In Japanese.*]—*J. Formosan Sug. Plant. Ass.* **16** no. 4 pp. 71–96. Taichu, Formosa, 1938.

In experiments in Formosa in which sugar-cane setts infested by larvae of *Eucosma schistaceana*, Sn., were planted, 71 per cent. of the larvae abandoned them and about 17·6 per cent. gave rise to adults. About 12·5 per cent. of the larvae attacked the buds and shoots. Seed-cane may, therefore, be a source of infestation in the field.

Takahashi (S.). **On the fatal Effect of Submersion upon the Sugar-cane Borers.** [*In Japanese.*]—*J. Formosan Sug. Plant. Ass.* **16** no. 6 pp. 113–120. Taichu, Formosa, 1938.

In experiments in Formosa, eggs, fifth- and sixth-instar larvae in sugar-cane stalks and exposed pupae of *Chilo infuscatellus*, Sn., were submerged in water. The periods of submersion that gave complete mortality were 7 days for the larvae and eggs and 5 days for the pupae. Newly laid eggs were less resistant. The pupae were least resistant soon after pupation and most so when half developed. Larvae of *Eucosma schistaceana*, Sn., and *Diatraea venosata*, Wlk., and pupae of *E. schistaceana* and *Sesamia inferens*, Wlk., were less resistant than the corresponding stages in *C. infuscatellus*.

Takahashi (S.). **On the Relation of the Degrees of Growth of Sugar-cane to the Oviposition of the Borers and the Appearance of the withered Hearts. 1. Observations on *Eucosma schistaceana* Snellen.** [*In Japanese.*]—*J. Formosan Sug. Plant. Ass.* **16** no. 7 pp. 135–153. Taichu, Formosa, 1938.

Observations in Formosa showed that half-grown sugar-cane, which is thickly leaved, is preferred by *Eucosma schistaceana*, Sn., for oviposition [*cf. R.A.E.*, A **24** 44], and most dead-hearts appear in this stage

of growth. Full-grown canes, 24–32 ins. in length, are preferred to young ones less than 8 ins. long, but fewer dead-hearts appear in them, since in this stage the borers do not attack the growing point of the stalk.

TAKAHASHI (R.). **On Mites injuring agricultural Plants in Formosa.** [*In Japanese.*]—*Bull. Govt Res. Inst. Formosa* no. 144, 10 pp., 3 figs. Taihoku, Formosa, July 1938.

Tetranychus telarius, L., is very common in Formosa, all stages being found throughout the year. Its numerous food-plants include castor, sweet potato, cassava, mulberry and radish, but it is rare on cotton, though very injurious to it in Korea [*cf. R.A.E.*, A **23** 371]. The Coccinellids, *Stethorus rotundatus*, Motsch., and *Scymnus* sp., and an unidentified Staphylinid are predacious on it, *Stethorus* sometimes reducing its numbers considerably. Another species of *Tetranychus* produces galls on the lower sides of the leaves of *Cephaëlis* (*Uragoga*) *ipecacuanha*, and *Stigmaeus floridanus*, Banks, injures seedlings of pineapple, on which it is common. *Tetranychina* sp. kills the leaves of the noxious weed, *Oxalis violacea*, from mid-April to July; it has not been found on other plants and is scarce from August to February. Eriophyids occur on some 16 species of plants in Formosa; they include *Phyllocoptruta* (*Eriophyes*) *oleivorus*, Ashm., which is very injurious to *Citrus*, but is well controlled by sprays of lime-sulphur, and an unidentified species of *Eriophyes* that attacks *Nephelium litchi*, and *N.* (*Euphoria*) *longana*, causing galls on the young leaves. The latter mite also occurs in Foochow, China. *Rhizoglyphus echinopus*, F. & R., is common on rocamboles [*Allium*] imported from Japan [*cf.* **24** 700] and China, but serious damage to them has not been observed in Formosa.

TSAI (P. H.) & CHUN (N. M.). **Preliminary Notes on *Mycalesis gotama* Moore injurious to the Rice Plant in China.** [*In Chinese.*]—*Ent. & Phytopath.* **5** no. 28–30 pp. 526–527. Hangchow, 1937. (Abstr. in *Lingnan Sci. J.* **17** no. 2 p. 313. Canton, 16th June 1938.)

Descriptions are given of the larva, pupa and adult of *Mycalesis gotama*, Moore; the larvae of this Satyrid are gregarious and feed on lowland rice and bamboo.

VAN DER VECHT (J.). **De toepassing van Derris.** [The Use of Derris.] —*Bergcultures* **12** pt. 31 pp. 1055–1062, 2 refs. Batavia, 30th July 1938.

This address to planters in Java opens with an account of the development of derris as an insecticide for dusts and sprays. For spraying, suspensions of derris powder have advantages over aqueous extracts. In 1937, the author found that the addition of 1–2 per cent. talc to spray suspensions used against *Artona* (*Brachartona*) *catoxantha*, Hmps., helped to fix the particles of derris on the smooth lower surface of coconut leaves and also served to indicate the thoroughness of application of the spray.

Whether used in dusts or sprays, derris powder is more effective if finely ground. It should pass a sieve of 200 meshes per linear inch, and as moisture impairs keeping quality, its moisture content should never exceed 10 per cent., much less being desirable. The question of

toxicity and its evaluation is discussed in some detail. Toxicity increases with rotenone content, but not to a proportionate degree [*cf. R.A.E.*, A **25** 765]. The author has found that a figure to express the toxicity of a given sample of derris powder, when it is used for dusting, may be obtained by the formula $(R + 10) \div 3$, where R is the percentage of rotenone in the sample. This formula gave figures that corresponded exactly or very closely with the relative toxicities of powders having rotenone contents of 0·5–13·6 per cent. in actual tests with Lepidopterous larvae on cabbage. It is not applicable, however, to powders containing practically no rotenone or those obtained from *Derris elliptica* with an abnormal relation between yields of rotenone and total extract. A table shows the dilution with talc of derris powders of different rotenone contents required to give dusts with toxicity figures of 1 and 0·5. Preliminary experiments have indicated that a similar difference between the rotenone content and toxicity of a powder is also apparent when it is used in a spray suspension, but it is less marked. A spray containing 0·02 per cent. rotenone has been found suitable for general use, but some insects, such as Aphids, can be controlled by weaker strengths [**24** 766].

MERINO (G.). **A Report on the Presence of the Coconut Zygaenid, *Artona catoxantha* Hamps., in the Province of Palawan.**—*Philipp. J. Agric.* **9** no. 1 pp. 31–37, 1 pl., 3 refs. Manila, 1938.

Artona catoxantha, Hmps., was first found to be present in the Philippines in 1927, when coconut groves at Puerto Princesa in the middle section of the island of Palawan were observed to be infested. Control was effected by cutting and burning the infested fronds. In 1931, the Zygaenid reappeared in the same place and simultaneously in groves about 20 miles away. The same control measures were applied at Puerto Princesa, and calcium arsenate sprays were also used in the other locality, from 1931 onwards. However, in mid-March 1937, adults were still emerging there, and infested fronds were still being burned. Two days later, a strong gale and torrential rain presumably caused a high mortality, as no further infestation in the locality was reported. No trees died as the result of attack. All stages of *A. catoxantha* are briefly described, and its habits and natural enemies are briefly reviewed from the literature [*cf. R.A.E.*, A **15** 128]. Many of the larvae collected in the island of Palawan had cocoons of *Apanteles* attached to the ventral surface. The adults were not attracted to Dietz lamps or a bonfire at night. The author considers that the possibility of accidental introduction of the moth into Palawan is remote and that it is probably indigenous.

SORIANO (P. S.). **A Report on Philippine Birds that prey on the Oriental Migratory Locust (*Locusta migratoria manilensis* Meyen).**—*Philipp. J. Agric.* **9** no. 1 pp. 43–59, 7 pl. Manila, 1938.

From a study of stomach contents, the author concludes that 27 species of birds are not injurious and feed on locusts (*Locusta migratoria manilensis*, Meyen), 17 doing so to a large extent, while a number of other species, although useful in this respect, are injurious to crops, fruit, poultry or small beneficial birds. It is suggested that the most useful species should be protected by law.

Proceedings of the Fourth International Locust Conference, Cairo, April 22, 1936.—97 pp. 51 sep. paged appendices, illus. Cairo, 1937. [Recd. October 1938.]

This Conference was attended by representatives of the Governments of the Union of South Africa, Saudi Arabia, Argentina, Australia, Belgium, Great Britain, Bulgaria, Canada, Chile, Egypt, Spain, the United States of America, Abyssinia, France, Greece, India, Iran, Iraq, Mexico, Portugal, Rumania, Uruguay and Jugoslavia. The proceedings and the resolutions are printed in both English and French. The following are brief summaries of the papers read and of the resolutions associated with them.

Buckell (E. R.). Summary of Losses and Expenditures due to Grasshoppers in Canada 1925–1934 (Appendix 1, 13 pp.). The annual losses and expenditure in each Province separately, as well as particulars of the crops damaged and of the species of grasshoppers concerned, and the totals under different headings for the whole period for the entire Dominion are given. The total monetary value of the crop lost is estimated at nearly £7,000,000, losses to livestock at over £174,000, the cost of control measures at nearly £353,000 and the value of unpaid labour at £530,000.

Parker (J. R.). Losses caused by Grasshoppers and the Expenditure incurred in their Control during the Period 1925–1934 (Appendix 2, 6 pp.). Particulars are given of the crops destroyed, the areas affected, the value of the crops lost, the cost of control measures, and the species of grasshoppers concerned in the United States. The value of crops each year in each State is tabulated, as well as the expenditure under different headings for the whole period by each state and by the Federal Government. The total crop loss and expenditure for control are estimated at £50,000,000 and £916,000.

Pertes causées par les sauterelles et dépenses faites pour les combattre pendant les années 1932–1935 ; Memorandum prepared by the Ministry of Agriculture, Mozambique (Appendix 3, 5 pp.). Mozambique was invaded by *Locusta migratoria migratorioides*, R. & F., in 1932–33 and by *Nomadacris septemfasciata*, Serv., in 1933–34 and 1934–35. The damage to crops and grazing in these three years is estimated at £15,500, £350,000 and £300,000, and the expenditure on control at £13,000, £26,000 and £27,000.

du Plessis (C.). Economic Importance of the Locust Problem in the Union of South Africa and South-west Africa (Appendix 4, 5 pp.). Tables show the losses caused by *Locustana pardalina*, Wlk., and *Nomadacris septemfasciata*, and the expenditure on their control. In the case of *Locustana*, the total estimate for losses and control measures is £138,000 a year for the period 1925–35. For the two years 1933–34 and 1934–35, the losses caused by *Nomadacris* are estimated at £60,000, while its control cost £883,500.

The Losses caused by Locusts and Grasshoppers and the Expenditure incurred in their Control in Australia during the period 1925–1934 ; Communicated by the Delegate of the Commonwealth of Australia (Appendix 5, 5 pp.). Particulars are given with regard to *Chortoicetes terminifera*, Wlk., which was present in New South Wales in 1928 and 1934, and in Victoria and Queensland in 1934–35, and *Austroicetes cruciata*, Sauss. (*pusilla*, auct.) which invaded Western Australia in 1934–35. During the period under review the sum expended on control in all the states was £20,300.

[Husain (A.)]. Statement showing the Estimates of Damages caused by Locusts, the consequent Revenue Remissions and the Expenditure on Control during the Years 1928–29 to 1930–31 in India ; Memorandum submitted by the Indian Delegation (Appendix 6, 4 pp.). The estimated damage to crops was about £675,000, while control and relief measures cost about £33,000 and £175,000, respectively.

In Resolution 1, Proc. pp. 48–52, it is agreed that statistics on the cost of controlling locusts and grasshoppers and the losses they cause should be collected in all countries affected by them and transmitted to the International Centre for Anti-Locust Research, and a questionnaire specifying the type of data required is proposed.

Uvarov (B. P.). Biological and ecological Basis of Locust Phases and their practical Application (Appendix 7, 16 pp.). A concise summary is given of the progress made in the study of the phase problem during recent years. It is concluded that the discovery of phase transformation, and the understanding of its mechanism and of the factors regulating it, afford a firm basis for replacing the present defensive anti-locust policy by a scientifically sound and practicable preventive policy. Since, however, the whole process of phase transformation is still not completely known and its details must be studied separately for every species and for every natural region, it is recommended that the first step towards the lasting solution of the locust or grasshopper problem in each country should consist in the organisation of research on the ecology and habits of the species concerned, with special attention to their phase transformations.

In Resolution 2, Proc. pp. 52–53, the foregoing propositions are agreed to, and it is recommended that support be given to laboratories in which experimental research on phases can be carried out.

Husain (M. A.). Some Factors responsible for the Development of black Colouration in *Schistocerca gregaria* Forsk. Hoppers (Appendix 8, 5 pp.). The information in this paper has already been noticed [*R.A.E.*, A **24** 737, 738 ; **25** 161].

Johnston (H. B.). Remarks on experimental and biometrical Study of Phases (Appendix 25, 9 pp.). The essential qualities characterising the phases and the fundamental causes of phase change are still largely a matter of theory, and much additional fundamental knowledge is required to elucidate periodicity phenomena and render the prognostication of swarming a certainty. The author suggests a division of the study of phases into physiological, biometrical, and ecological studies, and puts forward a number of suggestions as to the most effective way of pursuing them.

In Resolution 3, Proc. pp. 52–54, the value of biometrics in the study of phases is endorsed, and a diagram of measurements to be taken in calculating biometric ratios is included (Proc. p. 97). Studies should be undertaken to elucidate the physiological and biochemical processes underlying the external characters differentiating the phases.

Bodenheimer (F. S.). Factors controlling Locust Populations (Appendix 9, 11 p.). The potential progenies of a pair of locusts through 10 generations with different fertilities and mortalities in the immature stages are tabulated. If it is assumed that in ph. *solitaria* there is only one generation a year and the females lay 50 eggs, while in ph. *gregaria* there are 3–4 generations and the females lay up to 200 eggs, the mortality in immature stages being 50 per cent. in both cases, the progeny of one pair of ph. *solitaria* at the end of three years

would be about 4 million, whereas that of one pair of ph. *gregaria* would be over 1,000 million times that number. The factors counteracting such potential increase are food, parasites and predators and especially climate, which is most important during the egg stage and the early larval instars [*cf.* **18** 184, 623 ; **21** 400]. The process of the transformation of ph. *solitaria* into ph. *gregaria* is discussed. By analogy with non-swarming grasshoppers [*cf.* **24** 110], it is concluded that an increase to 10–50 times the normal population level would suffice to produce ph. *transiens*. A sequence of at least 2 or 3 years with optimum climatic and environmental conditions is essential for the enormous populations of the outbreaks built up by 3–9 preparatory generations. These are followed by 2–10 swarming generations, which continue increasing in numbers as long as environmental conditions remain favourable, for the increasing population of natural enemies is able to destroy only a part of the increment in the numbers of locusts from generation to generation. The breaking down of the process can be brought about only by a very radical change to unfavourable conditions, such as, in the case of *Schistocerca gregaria*, lack of rain during the breeding season or abnormal prevailing winds carrying migrating swarms into unsuitable areas [*cf.* **21** 11].

In Resolution 4, Proc. pp. 54–56, it is recommended to investigate the effect of climatic factors in all stages of the life-history, and to make quantitative population studies in outbreak areas, especially in the intervals between swarming periods.

Ramchandra Rao (Y.). A Study of Migration among the Solitaries of the Desert Locust (*Schistocerca gregaria* Forsk.) (Appendix 10, 14 pp.). The local and seasonal migrations of the swarms of *S. gregaria* in the Indian area [**22** 121] and the habitats and migrations of ph. *solitaria* [**22** 121, 122 ; **24** 443 ; **25** 161, 390] are discussed. It is concluded that the power of migration enables the solitary locusts to escape droughts and benefit by two breeding seasons, and that exceptionally good rainfall occurring both in winter and in summer breeding areas enable the locusts to pass through 3–4 consecutive generations and produce incipient swarms.

Quelques éléments pour l'étude des migrations des sauterelles en Mozambique ; Memorandum submitted by the Portuguese Delegation (Appendix 11, 13 pp.). Some old records on outbreaks of locusts in Africa are enumerated. *Nomadacris septemfasciata* was present in Portuguese East Africa from 1894 till about 1914, and reappeared in 1932. The course of the 1932–35 invasion is outlined, and it is concluded that Portuguese East Africa is subject to invasions by swarms originating to the north and west and passing across it on their southward migration.

Quelques éléments pour l'étude de l'action des moyens climatériques sur le " *Nomadacris septemfasciata* " dans la Colonie du Mozambique ; Memorandum submitted by the Portuguese Delegation (Appendix 26, 5 pp.). Observations are recorded on the directions of flights of swarms of *Nomadacris septemfasciata* in Portuguese East Africa in connection with those of winds. There, the swarms move in a general northerly and westerly direction during the cool season in June–August, and in the opposite direction in the hot season in October–December. In general, winds do not determine the direction of swarms, though they influence their orientation and, when strong, may prevent any flying. Excessive humidity is avoided, and absence of flight during the night may be due to high relative humidities. The influence of

temperature is not great, as swarms were seen to fly at temperatures ranging between 10 and 40°C. [50–104°F.]. It is concluded that the directions of migrations are determined not by meteorological factors but by search for food and suitable oviposition sites.

In Resolutions 5 and 6, Proc. pp. 56–62, and Resolution 13, Proc. p. 66, the need of collating information on migrations of different species is stressed, and a number of improvements on the present system of reporting suggested. Attention is drawn to the need of studying migrations of isolated locusts and grasshoppers of all phases, particularly by marking individuals, for further collaboration between meteorological and entomological services in the preparation of locust reports, and for developing a system whereby the territories liable to invasions by swarms should be notified by their neighbours.

Zolotarevsky (B. N.). Étude de la phase solitaire des acridiens dans les aires et foyers grégarigènes (Appendix 27, 13 pp.). The characteristics of outbreak centres and areas, as specified by the third International Locust Conference, are recapitulated and further elaborated and discussed with reference to the discoveries of the author and of other workers [*cf.* **22** 708 ; **24** 231, 234]. Suggestions are made as to microclimatic, vegetation, faunistic and population studies in the outbreak centres.

Johnston (H. B.) & Buxton (D. R.). Review of Anti-Locust Work in the East African Area for 1935 (Appendix 48, 9 pp.). The field work on discovery of possible outbreak centres of *Locusta migratoria migratorioides* and of conditions necessary for phase transformations [**22** 705] was continued. The area under investigation included the whole of Kenya and Uganda and small parts of adjacent territories, notably the southern Sudan and eastern Belgian Congo. It was found that East Africa as a whole provides no habitats favouring the survival of a permanent population of ph. *solitaria*, except in certain restricted localities, such as the shores of Lake Albert at 2,000 ft., the western shores of Lake Rudolf at 1,250 ft., Lake Baringo at 3,150 ft. and the southern Uaso Nyiro flood plain at 2,000 ft. Here are found the conditions apparently necessary for the survival of the solitary phase, *viz.*, an elevation of not over 3,500 ft., a mean monthly temperature seldom falling below 70°F., humidity not rising much over 70 per cent., perennial tufted grass not over 3 or 4 ft. high, interspersed with bare ground, a sandy or muddy soil for oviposition and a floodable surface. In such areas small populations of locusts lead a precarious existence, but are unlikely to transform into ph. *gregaria* owing to absence of suitable conditions. Some notes on *Nomadacris septemfasciata* in Uganda and Kenya are included.

In Resolutions 7, 8 & 9, Proc. pp. 62–63, it is recommended to concentrate studies in outbreak centres of locusts on the effect of ecological conditions on them, and to investigate the reasons for the occurrence of scattered individuals of ph. *gregaria* in the absence of swarms, and the possibility of changing artificially the ecological conditions in the outbreak centres to make them unfavourable for the formation of the gregarious phase.

Hussein (M.). Preliminary Notes on the Influence of Temperature on Locust Activity (Appendix 19, 11 pp.). The information contained in this paper has already been noticed [**26** 147].

In Resolution 10, Proc. p. 64, the importance of studying factors controlling locust activity is stressed, and some of the factors requiring investigation are suggested.

Buckell (E. R.). The Influence of Man on the Distribution of Grasshoppers in Canada (Appendix 12, 7 pp.). Draft Resolution (Appendix 13, 2 pp.). The Prairie Provinces of Canada were subject to outbreaks of grasshoppers even before they were brought under cultivation. The outbreak areas of *Melanoplus mexicanus*, Sauss., which is economically the most important species, probably coincided with the areas of greatest concentration of bison during drought, where the consequent overgrazing and loosening of the soil by trampling would create suitable conditions for oviposition, and where ph. *gregaria* could be produced as the result of the hoppers feeding on unusually dry material. From the end of the 18th century, the rapid destruction of bison and the growth of annual crops, which provided green food for the hoppers, have prevented the recurrence of ph. *gregaria*. *M. mexicanus* was favoured by the breaking up of the sod, for although the permanent breeding centres are still largely confined to undisturbed areas of native grasses, the cultivated lands furnish excellent oviposition sites and abundant food when the species begins to increase. In the case of *M. bivittatus*, Say, and *M. packardi*, Scudd., the breeding areas, which must have originally been very limited, have been increased by cultivation, and every road-ditch, border and abandoned field is now a potential oviposition site. *Camnula pellucida*, Scudd., has been favoured by the overgrazing of pastures, and in addition is maintained in numerous small unploughed patches scattered throughout the agricultural districts, so that it is a pest of both the open range and cultivated crops.

Eastern Canada was originally forested and free from serious grasshopper outbreaks, but recently, as the result of deforestation, outbreaks of *M. mexicanus*, *M. bivittatus* and *M. femur-rubrum*, DeG., have been recorded on sandy pastures. In British Columbia, the breaking up of the sod for fruit growing in the valleys has increased the breeding areas of *M. mexicanus*, while overgrazing of the interior dry belt has favoured *Camnula pellucida*. Fencing and rotation grazing, are now practised in many parts of British Columbia to make overgrazed areas unsuitable for oviposition [*cf.* **13** 196]. In addition, local breeding grounds, which are determined by edaphic conditions are treated with poison. In this way a severe outbreak was prevented from developing in the 900,000 acres of Nicola valley by the annual poisoning of grasshoppers on some 2,000 acres of known egg-beds from 1922 to 1933.

Parker (J. R.). The Influence of Man and Cultivation on the Grasshopper Problem in the United States (Appendix 14, 11 pp.). In the Great Plains Region, agricultural practices have, in general, benefited grasshoppers. In Montana, the permanent breeding grounds of *Melanoplus mexicanus*, which is now the most destructive species, were originally almost confined to sandy areas in river bottoms and sunny slopes in the foothills of the Rockies. Now, immense areas over which soil has been disturbed have been made available for oviposition, and the infestation is scattered all over the cultivations, where the presence of two egg-pods per square foot throughout a field is sufficient to result in the complete destruction of the crops. Other artificially created oviposition sites are provided by road-sides, fence-rows, ditch banks and accumulations of drift soil. The native grasses on which *M. mexicanus* originally fed dry up towards late July, when green vegetation becomes restricted to low-lying ground near the streams, lakes and water-holes. Here the adults would become concentrated

at the time of oviposition in August and September. During very dry years the native grasses begin to dry up already in May-June, so that local migrations to lower ground must have occurred in the late larval and early adult stages. The feeding on semi-dried vegetation, which has been experimentally shown to produce the characteristics of ph. *gregaria*, the concentration in restricted areas, and the stimulation of migratory instincts, probably combined to produce the gregarious phase of *M. mexicanus*, which last appeared in 1876. Now, green food is provided by crops or by weeds, such as *Salsola* sp., which remains green even in the dry season, there is no need for migrations or massing of population in restricted areas, and in spite of the great increase in suitable breeding areas, ph. *gregaria* is no longer produced.

M. differentialis, Thos., and *M. bivittatus*, which originally bred in the flood plains of rivers and streams and fed on rank-growing succulent vegetation, have greatly benefited from the introduction of cultivations. They are very susceptible to fungous and bacterial diseases, which normally kept down their numbers in wet years. Now, when they multiply in favourable years, they spread to cultivated land where there is plenty of food and of oviposition sites in the compact sod along fence-rows and road-sides, and where the less humid conditions enable them to survive the damp cloudy weather during which the populations in the original habitats are practically wiped out. During the increasingly dry years from 1930 to 1933, both species increased in numbers, developed strong powers of flight and widened their distribution areas, while after the exceptionally dry conditions in 1934 they disappeared from higher ground, but maintained their numbers in the original habitats. *Camnula pellucida* has greatly benefited by lumbering operations and the establishment of dairy farming in the northern sections of Michigan, Wisconsin and Minnesota, where approximately 6 million acres of potential breeding grounds have been created for this species, and where it sometimes does serious damage to pasture and hay. On the open plains of North Dakota, it has become adapted to a combination of grassland and crops, ovipositing in the sod along the highways, and moving on to the cultivated fields in the larval stage. In Montana, it occurs on the open foothills, and here the degree of infestation is proportional to overgrazing.

In Resolution 11, Proc. p. 64, it is pointed out that the excessive multiplication of many species of locusts and grasshoppers has been furthered by human activities, the effect of which calls for special investigations.

The Use of Poisons in Locust Control ; Memorandum submitted by the United Kingdom Delegation (Appendix 15, 15 pp.). The results of experiments on the destruction of locusts in flight by means of sodium arsenite delivered from aeroplanes [*cf.* **22** 706] are re-examined, and a summary is given of results of the research on arsenical and other compounds in locust control carried out at the Imperial Institute of Entomology [**25** 457].

Faure (Jacobus C.) & de Villiers (F. J.). Recent Developments in the Technique of Locust Destruction in South Africa (Appendix 16, 7 pp.). Until recently the standard method of locust control in South Africa was spraying with sodium arsenite. The spray was prepared by dissolving 112 lb. sodium arsenite in 10 gals. water, mixing the solution with 24 gals. sugar-cane molasses, and diluting the mixture with water at the rate of 1 : 50. It was applied by means

of bucket spray-pumps with Bordeaux adjustable nozzles and effectively destroyed locusts when used at the rate of 120 gals. per acre. The addition of soap or some other spreader improved the killing power of the arsenite solution, except in the case of *Nomadacris septemfasciata*, on which it acts mainly as a stomach poison. Field experiments on dusting have shown that to obtain a good kill within 36–48 hours, 6–8 lb. of sodium arsenite dust must be used per acre. The results of experiments on dusting resting swarms of *Nomadacris* from aeroplanes have been noticed elsewhere [**22** 706] ; subsequent experience indicates that dusts with a maximum percentage of particles of an average diameter of 0·06–0·07 mm. give the best results both for aeroplane dusting and for use with Barlow pumps. Dusting of large continuous areas from aeroplanes involves some danger to livestock, and this method is more suitable for sparsely stocked country, deserts and swamps.

The standard method now adopted against *Locustana pardalina* consists of poison baits prepared by mixing 92 lb. whole maize meal with 7 lb. molasses, 1 lb. sodium arsenite, and 3 parts per thousand of vegetable black to give a warning colour. The finished product must not contain more than 10 per cent. moisture ; it is moistened for application with 6–8 gals. water per 100 lb., and then scattered at the rate of 60 lb. dry weight per acre. The use of baits practically eliminates danger to livestock and is cheaper than spraying or dusting. They gave good results experimentally against *Nomadacris* adults, against which they could be used if small swarms were in open savannah bush country in cool winter weather.

Kamel Bey (M.). Locust Legislation in Egypt and principal Means for their Destruction (Appendix 17, 4 pp.). A brief account is given of the legislation concerning locusts in Egypt, where every capable person is obliged to participate in their control, which is carried out by means of the usual chemical and mechanical methods.

Cardoso (J. G. A.). Considérations sur les moyens de lutte en usage contre les *Nomadacris septemfasciata* (Appendix 18, 6 pp.). An account is given of the usual mechanical and chemical control measures used against *Nomadacris septemfasciata* in Portuguese East Africa. Spraying with sodium arsenite, the specifications of which are given, is considered to be the most efficacious method.

In Resolutions 12 & 14, Proc. pp. 64–70, it is agreed that sodium arsenite baits generally afford the most effective and economical method of direct control of locusts, but that research designed to discover a less dangerous insecticide should be continued. The conclusions of the third Conference with regard to dusting of swarms from aeroplanes [**22** 706] are re-affirmed with some modifications.

Contribution pour l'étude des ennemis du *Nomadacris septemfasciata* Serv. ; Memorandum submitted by the Portuguese Delegation (Appendix 28, 13 pp.). Descriptions are given of the parasites (including fungi, etc.) and Arthropod predators of *Nomadacris septemfasciata* in Mozambique, most of which have already been recorded [**24** 3, 444], and a list of birds attacking locusts is given. It is concluded that the effect of natural enemies is much greater than that of control measures.

In Resolution 15, Proc. p. 70, the conclusions of the third Conference with regard to fungi are re-affirmed [**22** 706], and it is recommended to investigate the importance of birds in destroying locusts and grasshoppers.

Ramchandra Rao (Y.). Some Outbreak Centres of *Schistocerca* in Mekran (Appendix 30, 9 pp.). Most of the information in this paper has already been noticed [**25** 161, etc.]. It is concluded that in the winter rainfall areas of Baluchistan, rain is the most decisive factor in the origination of outbreaks of *Schistocerca gregaria* in India, for it leads to extensive breeding and building up of the population in the coastal areas. The new generation migrates into the interior of Mekran in April, where provided that rainfall is favourable, concentrated egg-laying occurs, leading to incipient swarming. The adults of the second generation then migrate into Sind and Rajputana, where breeding and formation of large swarms may occur during the monsoon rains.

Further Investigations on the Desert Locust *Schistocerca gregaria* (Forskål). Programme proposed by the Technical Committee of the Conference (Appendix 29, 3 pp.); Resolution 16, Proc. p. 70; Recommendations 3, Proc. p. 88. Recent investigations on the outbreak centres of *Schistocerca gregaria* [*cf.* **22** 121; **24** 231] are reviewed, and the areas where further investigations are required are enumerated, their study being allocated to the respective Governments. The existence of outbreak centres on the Red Sea coasts of Africa and Arabia is recognised, and their periodical patrolling to suppress incipient outbreaks is strongly recommended.

Faure (J. C.). Investigations on the Red Locust and Supervision of its Outbreak Centres (Appendix 20, 3 pp.). The view of the Government of South Africa that the most important part of investigations on *Nomadacris septemfasciata* consists of the study of its behaviour in the known outbreak centres in Tanganyika and Northern Rhodesia, and in the search for other possible outbreak centres, is expressed, and the part played by the Union Entomologists in such investigations is described. It is suggested that the Conference should consider definite plans for the permanent supervision of the known outbreak centres.

Quelques éléments pour l'étude des phases "*solitaria*" et "*transiens*" du *Nomadacris septemfasciata* Serv.; Memorandum submitted by the Portuguese Delegation (Appendix 24, 6 pp.). Although no example of *Nomadacris septemfasciata* was found in Portuguese East Africa between 1911 and 1930, a few *solitaria* individuals were discovered near Lake Nyassa in July 1931. This area is, however, unsuitable for extensive breeding, while the locusts in question may have been derived from a small unnoticed invasion in 1930, so that it is concluded that the existence there of a local outbreak centre is impossible.

Michelmore (A. P. G.). Plan for Investigations on *Nomadacris septemfasciata* (Serv.) (Appendix 34, 8 pp.). Although the last outbreak of *Nomadacris septemfasciata* in Africa originated in not more than 3 centres (in the Mweru-Tanganyika Lowlands in north-eastern Rhodesia and near Lake Rukwa in south-western Tanganyika), it is thought that a fairly large number of areas, scattered over tropical Africa, will eventually be considered as potential outbreak centres. Field investigations have shown that the habitats of the solitary forms are restricted to more or less open grasslands. The distribution and characteristics of different types of these are outlined; the most dangerous ones appear to be the grasslands of low and moderate elevations, in which all the known outbreak centres of *Nomadacris*

are situated. An account of extensive and intensive ecological investigations carried out since the third International Locust Conference and a programme for future work are given. The general policy for supervision of outbreak centres is outlined.

Resolution 17, Proc. p. 72 ; Recommendation 1, Proc. pp. 82–86. The areas requiring further reconnaissance, periodic observation and intensive research with regard to *Nomadacris septemfasciata* are enumerated, the known outbreak centres are specified, and a plan for their permanent supervision recommended.

The Origin of the present Outbreak of the African Migratory Locust *Locusta migratoria migratorioides* (Reiche & Fairmaire) in Africa and the Prevention of future Outbreaks ; Memorandum submitted by the United Kingdom Delegation (Appendix 21, 5 pp., 1 map.). The last outbreak of *Locusta migratoria migratorioides* in Africa is briefly described [*cf.* **19** 709 ; **21** 32, 401 ; **22** 45, 701 ; **23** 637], and the successive stages of the invasion of the continent from 1928 to 1934 are illustrated by a map. It is shown that the outbreak originated in a single restricted area in French Sudan, where natural conditions favour the production of the swarming phase [**22** 708 ; **24** 234]. There is some possibility that the latter might also be produced in the Hawash valley in Abyssinia and in parts of Angola and South Africa, but all available evidence points to the conclusion that the Middle Niger area was the sole source of the last outbreak, so that the establishment there of a permanent organisation for the suppression of incipient outbreaks would mean the virtual liberation of tropical Africa from this locust.

Projet de " Déclaration et voeux " soumis par la Délégation française (Appendix 22, 3 pp.). A brief survey is given of the way in which work was undertaken under the auspices of the Comité français d'Etudes de la Biologie des Acridiens, in accordance with the recommendations of the third Conference [*cf.* **22** 704–709], and that which it is proposed to carry out in future ; and the need for considering the organisation of permanent supervision in the outbreak centres of locusts is stressed.

In Recommendation 2, p. 86, the initiation of discussions between the Governments concerned, with regard to the establishment of a permanent organisation for the control of *Locusta migratoria migratorioides* in the Middle Niger area, is urged.

Faure (J. C.) & Marais (S. J. S.). The Control of *Locustana pardalina* in its Outbreak Centres (Appendix 37, 5 pp., 1 map.). The outbreak centres of *Locustana pardalina*, the characteristics of which have been reviewed elsewhere [**25** 632], are situated in the Karroo district of Cape Province and adjoining parts of the Orange Free State, the two major centres being at Middleburg and Hopetown, and the minor ones at Bethulie and Kenhardt. Control is carried out mainly by the occupiers of the land, by means of poison baits, and it is hoped to employ a sufficient number of permanent technical officers to keep the outbreak centres under constant supervision.

In Resolutions 18, 19 & 20, Proc. pp. 74–76, the need for continuing surveys and studies of known and suspected outbreak centres of *Locustana pardalina* is stressed, and the problems awaiting solution with regard to this species are outlined ; it is recommended that investigations organised against *Schistocerca paranensis*, Burm., in South America should follow the lines laid down by successive International Locust Conferences [**20** 160 ; **21** 51 ; **22** 704] ; and a similar

recommendation is made with regard to *Locusta migratoria manilensis*, Meyen, in the Far East.

Tammes (P. M. L.). Les sauterelles émigrantes aux Indes-Néerlandaises (Appendix 38, 4 pp.). Records are given of the appearance of swarms of *Locusta migratoria manilensis* in islands to the north and east of Celebes [*cf.* **24** 237].

Pasquier (R.). L'organisation des recherches et de la lutte rationelle contre le criquet marocain en Algérie (Appendix 39, 12 pp.). During recent years, control of *Dociostaurus maroccanus*, Thnb., in Algeria has been effected by constant supervision of outbreak areas by a special staff, and by destruction in them of all agglomerations of phases *congregans* and *silitaria* by means of poisoned baits. These are prepared by mixing 100 lb. wheat bran, 5 lb. sodium arsenite, 5 lb. molasses, and sufficient water to moisten the bran, and when used against ph. *solitaria* have had to be applied up to 5 times in the same locality. The characteristics of the outbreak areas, which occur in the Departments of Oran, Algiers and Constantine, are described [**25** 536]. The cost of control by this system in 1934 and 1935 was only 801,000 francs, comparing favourably with the average annual expenditure of 10 million francs during the period 1925–30.

Gradojević (M.). Compte rendu sur la dernière lutte contre le criquet marocain en Yougoslavie, 1933 (Appendix 40, 8 pp.). In Jugoslavia, both *Calliptamus italicus*, L., and *Dociostaurus maroccanus* are of economic importance, the former in the south-western and the latter in the north-eastern part of the country. An outbreak of *Dociostaurus maroccanus* began in 1930 and reached a peak in 1932, when damage to the value of some £4,000 was caused to crops. To prevent an outbreak in 1933, the egg-deposits were delimited and an extensive campaign was carried out by means of steel brushes and poison baits, costing about £6,000, and involving an expenditure of 10,000 man-days and about 11,000 horse-days.

Ghadimi (D.). Informations communiquées par les Délégués de l'Iran à la IV-me Conférence Internationale des Recherches Anti-acridiennes du Caire, sur l'activité des acridiens en Iran (Appendix 50, 2 pp.). Locusts have been known in Iran since antiquity, the species concerned being *Dociostaurus maroccanus* and *Calliptamus italicus*. During the 1935–36 invasions, they damaged crops to the value of 400,000 million francs, and their control, which was carried out mainly by poison baits, cost over 2 million francs.

In Resolution 21, Proc. pp. 76–78, international regional action for the discovery and control of outbreak centres of *Dociostaurus maroccanus*, further field and laboratory study of its bionomics, and special investigations of control methods are recommended, and a grouping of countries for regional co-operation is suggested. In Resolution 22, Proc. p. 78, it is recommended to undertake research on conditions governing the multiplication of *Calliptamus italicus*, and in Recommendation 4, Proc. pp. 88–92, a plan for international cooperation in eastern Europe, for protection against both species, is approved.

El Zoheiry (M. S.). The Life History, Habits and Methods of Control of the Egyptian Grasshopper *Anacridium aegyptium*, L. (Appendix 41, 10 pp.), and Resolution 23, Proc. p. 80. Swarms of *Anacridium aegyptium*, L., which is apparently indigenous in Egypt, appeared in Asyut Province in 1927 and 1928 and in Maryut Province in 1928 ; they oviposited in cultivated fields and did some damage to cotton and other crops. In the field, the males were observed to reach

sexual maturity a month after becoming adult, but the females did so only in the following spring, pairing and ovipositing in April and May. The egg and nymphal stages last about six weeks and two months, respectively, and there is one generation a year. Notes are given on cage observations on the duration of various stages of the life-history. A study of the movements of *A. aegyptium* suggests that it hibernates in Wady Asyut, and perhaps in Kharga oasis. Poison baits have proved unsuccessful in control, which is carried out by collecting in nets or by hand, dusting the cotton on which hoppers feed with calcium arsenite or sodium fluosilicate, and burning the adults with flame-throwers. Annual patrolling of hibernation quarters to prevent outbreaks of this species is recommended.

Buckell (E. R.). The Grasshopper Problem in Canada with an Outline of the proposed Investigation for its more economic Solution (Appendix 42, 7 pp.), and Draft Resolution on Grasshopper Problem in Canada (Appendix 43, 3 pp.); Parker (J. R.). The Grasshopper Problem in the United States (Appendix 44, 20 pp.). Much of the information in these papers is similar to that in those noticed above (pp. 676, 680). The organisation of anti-locust research in both countries is described. Parker states that *Schistocerca paranensis* has recently been invading cotton and garden crops in the Gulf States, while the Mormon cricket, *Anabrus simplex*, Hald., is of great economic importance in the Rocky Mountains and Plateau States. In general, grasshopper control is carried out by poison baits; the formula successfully used by the Federal Government in 1934 was 60 lb. wheat bran, 20 lb. sawdust, 15 lb. molasses, 5 lb. crude arsenic and 10–12 U.S. gals. water. Liquid sodium arsenite containing 32 per cent. As_2O_3 or sodium fluosilicate can be used at the rate of $\frac{1}{2}$ U.S. gal. or 4 lb., respectively, per 100 lb. carrier. Eggs are generally destroyed by ploughing the oviposition sites.

In Resolution 24, Proc. pp. 80–82, a plan for joint research on grasshoppers in Canada and the United States is approved. It includes historical studies of past outbreaks, in order to determine the outbreak centres, the establishment of intensive study areas, annual surveys of territories subject to grasshopper damage, and exchange of information.

Notes on Australian Grasshopper Plagues, and Two Grasshoppers of economic Importance in Queensland; Memoranda submitted by the Delegate of the Commonwealth of Australia (Appendix 45, 1 p., and Appendix 46, 3 pp.). During the period 1925–35 there was an important outbreak of *Chortoicetes terminifera* in 1933–35 in the eastern States, and one of *Austroicetes cruciata*, Sauss. (*pusilla*, auct.) in 1934–35 in Western Australia. Minor outbreaks of other species in Queensland [*cf.* **25** 633] and of *Locusta migratoria*, L., in Western Australia also occurred. Considerable damage was done to various crops, and poison baits to the value of over £25,000 were supplied to landowners. In Resolution 25, Proc. p. 82, satisfaction is expressed at the steps taken towards a comprehensive study of grasshoppers in Australia.

Husain (M. A.). A Summary of Investigations on the Desert Locust *Schistocerca gregaria* (Forskål), at Lyallpur during 1934 and 1935 (Appendix 31, 5 pp.). The results of the investigations carried out are summarised [*cf.* **24** 443, 634, 737, 738], and a programme of future work on various aspects of the biology of *Schistocerca gregaria* is given.

Mistikawy (A. M.). Further Observations on the Biology of the Desert Locust (*Schistocerca gregaria*, Forsk.) in Egypt (Appendix 32, 16 pp., 1 graph). Observations made in 1930–35 on the biology of *Schistocerca gregaria* in outdoor cages in Cairo largely confirmed those made previously [*cf.* **21** 400] ; they concern the number of egg-pods laid by the females ; the maximum number of eggs ; the duration of oviposition and the oviposition period ; the duration of incubation, hatching and adult life ; and the number of generations annually. In outdoor cages, four complete generations and a partial fifth were produced per year.

Bredo (H. J.). Sommaire des observations faites au Congo Belge et projet des futures recherches sur les acridiens migrateurs (Appendix 33, 8 pp., 3 maps). An account is given of work on locusts carried out in the Belgian Congo in accordance with the recommendations of the third Conference. The results obtained from a study of swarm movements and field investigations on *Locusta migratoria migratorioides*, *Nomadacris septemfasciata*. and *Homorocoryphus vicinus*, Wlk., have already been noticed [**25** 9]. In connection with *Nomadacris*, the need for detailed investigation of the marshes on the Rhodesian and Belgian sides of Lake Moero is stressed.

Contribution pour l'étude biologique du *Nomadacris septemfasciata*, Serv. ; Memorandum submitted by the Portuguese Delegation (Appendix 35, 10 pp.). Descriptions and biometrics of various stages of *Nomadacris septemfasciata* ph. *gregaria* are given, as well as notes on the biology of this species in Mozambique, and lists of the plants attacked by it and those that are immune.

Faure (J. C.). Organisation of Locust Research in the Union of South Africa (Appendix 36, 2 pp.). An account is given of the organisation and staff of the Locust Research Section of the Union Department of Agriculture and Forestry.

Locust Investigations carried out in the Period 1934–1936; Memorandum submitted by the United Kingdom Delegation (Appendix 47, 10 pp.). An account is given of work carried out under the auspices of the Economic Advisory Council, both at the International Centre for Anti-Locust Research, where it involved collation and analysis of printed matter, and fundamental laboratory research on the physiological effect of poisons on locusts [*cf.* **25** 457], and on the effect of external factors on breeding in *Schistocerca gregaria*, *Locusta migratoria migratorioides* and *Nomadacris septemfasciata* [**24** 227], and in Africa and Arabia, where ecological work was continued on the outbreak centres of the above three species. A list of papers on the locust problem by members of the staff of the Imperial Institute of Entomology is appended.

Invasion actuelle du criquet migrateur africain, *Locusta migratoria migratorioides* (Reiche et Fairmaire) dans l'Afrique Orientale Portugaise; Memorandum submitted by the Portugese Delegation (Appendix 23, 4 pp.). The migrations and breeding of *L. m. migratorioides* in Portuguese East Africa in 1932–34 are described.

Queiroz (J. B. R.). The Locust Invasion in Angola (Appendix 51, 17 pp.). An account is given of movements and breeding of locusts in Angola in late 1934 and 1935 and of the organisation of control and the usual mechanical and chemical methods used. Most of the swarms consisted of *Nomadacris septemfasciata*, but *Locusta migratoria migratorioides* was reported in the Malanje and Moxico districts, and *Locustana pardalina* in Mossamedes. Natural enemies of *Nomadacris*

included *Empusa grylli*, *Scelio howardi*, Crwf., *Stomatorrhina lunata*, F., and *Sarcophaga* sp. The value of crops damaged in 1932–33 was £200,000, while control and relief in 1932–35 cost £61,000 and £60,000, respectively.

de Peyerimhoff (P.). Organisation internationale des recherches anti-acridiennes (Appendix 49, 7 pp.). Past and present organisations for international co-operation in anti-locust control and research are outlined. A scheme is proposed according to which the International Anti-Locust Conferences should meet every two years, the resolutions should be carried out by local Committees, and the Imperial Institute of Entomology, London, should remain the International Centre for Anti-Locust Research. A list of outstanding problems requiring investigation in the laboratory and the field is included.

Snedecor (G. W.). **Statistical Methods.**—Demy 8vo, xiii+388 pp., illus., many refs. Ames, Iowa, Colleg. Press, Inc., 1938. Price $3·75.

This introduction to statistical method is designed primarily for workers in agriculture and biology who have no knowledge of advanced mathematics. The material is arranged so that the concepts are presented not so much in logical sequence as in order of increasing difficulty. The only branch of mathematics used is arithmetic, supplemented by the symbolism that is necessary for lucidity. Numerous examples, to be worked out by the reader, are given throughout the book, and in them statistical method with its meaning is emphasised and the necessary drudgery of calculation is reduced to a minimum. Tests of the adequacy of experimental technique are considered, as the aim of the author is to provided the beginner with a smoothly working combination of experimental data and statistical method.

Nixon (G. E. J.). **Five New Asiatic Telenominae (Hym., Proctotrupoidea).**—*Ann. Mag. nat. Hist.* (11) **1** no. 6 pp. 584–593, 4 figs. London, June 1938.

The new species described are : *Telonomus usipetes*, reared from eggs of *Hapalia machaeralis*, Wlk., in Burma, *T. olynthus*, *T. periparetus* and *T. ochus*, from eggs of a Pyralid, a Geometrid and the Drepanid, *Oreta carnea*, Btlr., respectively, all on *Uncaria gambir* in Sumatra, and *T.* (*Aholcus*) *urios*, from eggs of the Hesperiid, *Hidari irava*, Moore, in Malaya.

China (W. E.). **Synonymy of *Engytatus tenuis*, Reut. (Tobacco Capsid).**—*Ann. Mag. nat. Hist.* (11) **1** no. 6 pp. 604–607, 1 fig. London, June 1938.

The author briefly reviews the status and scope of the genera *Dicyphus*, *Engytatus*, of which the type is *E. geniculatus*, Reut., and *Cyrtopeltis*, of which the type is *C. geniculata*, Fieb., and concludes that *Cyrtopeltis tenuis*, Reut., should be referred to *Engytatus*. He shows that the synonyms of this species include *Dicyphus nicotianae*, Kon., and *D. nocivus*, Fulmek [*cf. R.A.E.*, A **14** 327, 622], as well as *Gallobelicus crassicornis*, Dist., which is the type of its genus. He also

points out that *Neoproba varians*, Dist., is a synonym of *E. geniculatus*; this is the specific name used to replace *geniculatus*, Reut., by authors who consider it referable to the genus *Cyrtopeltis* [*cf.* **22** 421].

Massee (A. M.) & Greenslade (R. M.). **The Fauna of the Weevil "Sack-band." III.**—*Ann. Mag. nat. Hist.* (11) **1** no. 6 pp. 607–610, 9 refs. London, June 1938.

Records of the insects trapped in bands of sacking on apple trees in England in 1935–1937 showed the presence of a further 100 species [*cf. R.A.E.*, A **18** 602; **23** 706], 80 of which are listed, thus bringing the total to 260. Although *Anthonomus pomorum*, L., was predominant, *Cydia pomonella*, L., and *Otiorrhynchus singularis*, L., were present in large numbers. Comparisons of these lists with those for Germany [**23** 704, etc.] and Sweden [**14** 611] show a considerable similarity.

Deshusses (J). & Deshusses (L.). **Observations sur quelques insectes nuisibles aux cultures.**—*Mitt. schweiz. ent. Ges.* **17** pt. 6 pp. 226–231, 18 refs. Berne, June 1938.

Instances are given of injury caused during the last two or three years by five species of insect pests in Switzerland. They comprise *Hepialus lupulinus*, L., on many plants, notably geraniums, *Oxythyrea funesta*, Poda, on a variety of flowers and vegetables, *Phthorimaea atriplicella*, F. R., on beet, *Pulvinaria floccifera*, Westw., on *Euonymus*, and *Nephrotoma* (*Pachyrhina*) *maculata*, Mg., on carnations. Some previous records of their food-plants and distribution are reviewed from the literature.

Blanchard (E. E.). **Dípteros argentinos nuevos o poco conocidos.** [New or little known Argentine Diptera.]—*Rev. Soc. ent. argent.* **9** pp. 35–58, 8 figs. Buenos Aires, 31st December 1937.

The new species described include the Phorid, *Puliciphora pectinata*, reared from eggs of *Schistocerca paranensis*, Burm., and the Tachinids, *Parabillaea* (gen. n.) *rhynchophorae*, from larvae of *Rhynchophorus palmarum*, L., and *Celatoria bosqi*, from adults of *Diabrotica speciosa*, Germ.

Daguerre (J. B.). **Nuestros actuales conocimientos sobre la langosta.** [Our present Knowledge on Locusts.]—*Rev. Soc. ent. argent.* **9** pp. 73–91. Buenos Aires, 31st December 1937.

Much of the information in this paper on locusts in Argentina has already been noticed [*R.A.E.*, A **23** 74; **26** 146]. A concise summary is given of the difference in morphology, colour and bionomics between the true *Schistocerca paranensis*, Burm., which is permanently gregarious and migratory, and *S. cancellata*, Serv. It has been thought that the latter may represent the solitary phase of the former, but the author considers it a distinct species.

Sauer (H. F. G.). **Origens das infestações dos algodoaes paulistas pela lagarta rosada.** [The Sources of the Infestations of Cotton Fields in São Paulo by the Pink Bollworm.]—*O Biologico* **4** pts. 4–5 pp. 108–114, 153–158, 2 figs. S. Paulo, April–May 1938.

In view of the increasing infestation of cotton in São Paulo by *Platyedra gossypiella*, Saund., the author briefly surveys the various

sources of infestation in fields. The principal sources are crop débris, which should be collected and destroyed before ploughing, waste cotton and débris from cotton mills, which is often used as a fertiliser, and may contain many larvae, seed stores, and food-plants other than cotton, which in order of importance are *Hibiscus esculentus*, *H. bifurcatus*, *H. subdariffa*, and *Althea rosea*. The occurrence of long-cycle larvae in cotton seeds was demonstrated.

Entomology.—*Rep. Ala. agric. Exp. Sta.* **45** pp. 26–28. Auburn, Ala. [1935]; *Op. cit.* **46** pp. 21–23 [1936]; *Op. cit.* **47** pp. 25–27 [1937]. [Recd. August 1938.]

In these reports, summaries are given of investigations on insect pests carried out in Alabama between July 1933 and the end of 1936, many of them in continuation of previous work [*cf. R.A.E.*, A **23** 413]. The 46th report covers the period 1st July 1934 to 31st December 1935.

A 3-year study, ending in 1934, by L. L. English showed that the application of oil emulsions against the red spiders (*Paratetranychus* spp.) on satsuma oranges in July and September effectively prevented winter infestation, but left a marked residue. In the laboratory, a tank-mix oil spray was more effective than several proprietary emulsions against purple scale (*Lepidosaphes beckii*, Newm.) and white fly (*Dialeurodes citri*, Ril. & How.) on *Citrus*. In 1934–35, the latter was more effectively controlled by sprays of derris powder when combined with oil emulsions (0·5 and 1·0 per cent.) than with more specific wetting agents. The effectiveness of the derris was lowered in both acid and alkaline wetting media and by liquid lime-sulphur; with soap it was more effective than nicotine sulphate or organic thiocyanate sprays. Other experiments in 1934–35 showed that two summer applications of oils were more effective than one against *L. beckii* and *Paratetranychus*, but the use of sulphur in the schedules was necessary for the control of *Phyllocoptruta* (*Phyllocoptes*) *oleivorus*, Ashm. (rust mite). The addition of selocide [potassium ammonium selenosulphide] to oil sprays increased their effectiveness against this mite. In other tests, it was almost completely controlled by frequent applications of lime-sulphur, wettable sulphur and sulphur dust, but these were ineffective against *Paratetranychus*.

Investigations by H. S. Swingle in 1933–34 showed that phosphates were present in the digestive juices of leaf-eating insects, and were especially abundant when these were alkaline. The speed of decomposition of the common arsenical insecticides depended on the pH value of the solution and on the anions present; it was little affected by the phosphate ion when the pH value was between 2 and 5, but between 6 and 10 it was increased, as was also the extent of decomposition. Tests in 1934–35, when insects were used in which the pH value of the digestive juices ranged from 6·0 to 9·6, showed that the toxicity of acid lead arsenate, calcium arsenate and magnesium arsenate could be correlated with the amount of soluble arsenic released from them in phosphate solutions with corresponding pH values. Insectary records given in the 45th report showed that mortality of larvae of *Curculio caryae*, Horn (pecan weevil) in the soil was approximately 77 per cent.; 18 and 5 per cent. gave rise to adults after 2 and 3 years, respectively. At harvest, unjarred pecan trees and those which had been jarred showed 67 and 87 per cent., respectively, of uninfested

nuts [*cf.* **24** 27]. The larvae were not controlled by applications of disease organisms to the soil. In 1934–35, it was found satisfactory to begin jarring on about 15th August, with 3 or 4 repetitions at weekly intervals.

In the 47th report, E. L. Mayton and J. M. Robinson give further details of the effect of dusting with calcium arsenate for the control of the boll weevil [*Anthonomus grandis*, Boh.] on plots of cotton used for experiments with different rates of application of a chemical manure. In 7 of the 13 years for which the manuring experiment was carried out, the infestation necessitated dusting, and this resulted in an average increase of 352 and 55 lb. seed cotton per acre on the fertilised and unfertilised plots, respectively.

Investigations by J. M. Robinson showed that the number of eggs laid by a female of *Listroderes obliquus*, Klug, during a period of 4½ months from 10th January 1934 varied from 13 to 1,989 and averaged 795·5 ; the average durations of the egg, larval and pupal stages were approximately 18, 18, and 11 days, respectively. Of 50 females observed during the summer of 1936, 18 began to deposit eggs in mid-November and continued throughout December ; the number per female varied from 2 to 111 and averaged 49·5.

F. S. Arant describes further experiments for the control of *Chalcodermus aeneus*, Boh., on cowpeas In 1933–34, 8 applications of dusts of calcium arsenate (which slightly scorched the foliage), and sodium fluosilicate containing 25 per cent. colloidal silica, reduced the injury to 5·5 and 9 per cent., respectively, as compared with 31 and 29 per cent. on the corresponding control plots. Very little reduction in injury was obtained by 8 treatments with pyrethrum dust or with a proprietary dust containing rotenone, pyrethrins, nicotine, residual deposit of rotenone and an inert material. In 1936, the average percentage infestations on plots dusted with magnesium arsenate, autoclaved calcium arsenate, and sodium fluosilicate containing 50 per cent. colloidal silica were 10·99, 9·01 and 10·74, respectively, as compared with 30·77 on the untreated plots. No injury was caused except by the calcium arsenate, which severely scorched the leaves.

Fox (D. E.). **Occurrence of the Beet Leafhopper and associated Insects on secondary Plant Successions in Southern Idaho.**—*Tech. Bull. U.S. Dep. Agric.* no. 607, 43 pp., 4 figs., 11 refs. Washington, D.C., May 1938.

In this paper are recorded the results of studies carried out from 1928 to 1933, inclusive, on the insects predominating on the successions of plant cover that develops on newly abandoned land in southern Idaho. It is shown that the annual weeds that occur in the earlier part of the succession support large populations of insects, particularly *Eutettix tenellus*, Baker, and that those that occur later do not result in the economically important production of this leafhopper or other injurious insects [*R.A.E.*, A **20** 725 ; **25** 715].

Service and Regulatory Announcements, January–March 1938.—*S.R.A., B.E.P.Q.* no. 134 pp. 1–37. Washington, D.C., U.S. Dep. Agric., June 1938.

Information in this part includes summaries of plant-quarantine restrictions issued by Italy, the Union of South Africa, the Gold Coast,

Iraq, Japan, the Australian Territory of Papua, and St. Kitts–Nevis ; and also amendments to summaries already noticed of restrictions issued by France, Sweden, Bulgaria, Jugoslavia, Egypt, Morocco, Persia, Ceylon, French Colonies (Oceania), British Honduras, Salvador and Argentina.

FELT (E. P.). **A new Species of Gall Midge predacious on Mealybugs.**—*Proc. Hawaii. ent. Soc. 1937* **10** no. 1 p. 43. Honolulu, July 1938.

Descriptions are given of both sexes of *Dicrodiplosis guatemalensis*, sp. n., reared from larvae predacious on mealybugs in Guatemala.

FULLAWAY (D. T.). **Orchid Insects.**—*Proc. Hawaii. ent. Soc. 1937* **10** no. 1 pp. 45–49. Honolulu, July 1938.

Very brief notes are given on a large number of insects that attack or are associated with orchids, particularly those that occur or have been intercepted in Hawaii. Two of the most injurious species are the weevils, *Orchidophilus aterrimus*, Waterh., and *Diorymerellus laevimargo*, Champ. The former has often been intercepted in Hawaii on orchids from the Philippines and other parts of Asia and has occasionally been observed in orchid houses there, but it is doubtful whether it has become established. The larva generally burrows in the base of the stem, causing discoloration or die-back. It should be excised and the wound sterilised with a fungicide to prevent further necrosis. *D. laevimargo* is well established in the United States and occurs in the houses of many firms that ship orchids to Hawaii, so that it is likely to be introduced. Measures for control are reviewed [*R.A.E.*, A **26** 550].

SWEZEY (O. H.). **Identity of the Nutgrass Armyworm in Hawaii.**—*Proc. Hawaii. ent. Soc. 1937* **10** no. 1 pp. 75–76. Honolulu, July 1938.

The nutgrass armyworm in Hawaii, which has for many years been known as *Spodoptera mauritia*, Boisd. [*R.A.E.*, A **22** 306 ; **23** 342 ; **24** 380] has now been identified as *Laphygma exempta*, Wlk. A brief note is given on some superficial characters by which the adults of the two species may be distinguished.

SAKIMURA (K.). **Thysanoptera of Kauai with Notes on the Incidence of Yellow Spot on wild Host Plants.**—*Proc. Hawaii. ent. Soc. 1937* **10** no. 1 pp. 167–173, 1 map. Honolulu, July 1938.

Of 16 species of Thysanoptera collected on Kauai in June 1937, only 3 had been previously recorded from this island, and 3 others are undescribed. A list is given of the named species with their food-plants. A large colony of *Microthrips piercei*, Morg., was found on carrot, and slight infestations were observed later on other vegetables, which were not noticeably affected.

The distribution is discussed of 3 species of *Emilia*, the major wild host-plants of yellow spot of pineapple, and the preferred food-plants of *Thrips tabaci*, Lind., the vector of this virus. A map shows the areas in which infected plants were found and their relation to the pineapple plantations.

Djou (Y. W.). **Lychee Fruits destroyed by** *Deudorix epijarbas* **Moore (Lepidoptera : Lycaenidae).**—*Lingnan Sci. J.* **17** no. 3 pp. 401–406, 1 pl. Canton, 1st July 1938.

Descriptions are given of the immature stages and of the adults of both sexes of *Deudorix epijarbas*, Moore, which was found infesting potted litchee plants near Canton [*cf. R.A.E.*, A **16** 249]. The plants concerned were growing in the open and were bearing flowers and fruit. Eggs found on the fruit in mid-April were identical with those deposited by this Lycaenid under laboratory conditions. From 19th to 22nd April, one female laid 69 eggs, usually not more than 2 on each fruit, on the calyx, the pedicel or the base. Newly hatched larvae bore into the fruit in about 40 minutes and feed on the seed ; if it is small they may attack another fruit before becoming full-grown. Pupation takes place under leaves or other débris on the ground. When the eggs were deposited in April, the egg, larval, prepupal and pupal periods were 5–6, 16–19, 3 and 10–11 days, respectively. Adults given water but no food lived for 4–5 days.

Infestation was severe, 11 out of 18 fruits on one branch being attacked. Large fruits were as heavily infested as small ones. If a small larva leaves a very young fruit after having made only a small tunnel, the fruit does not usually drop [*cf. loc. cit.*] and may grow to maturity, the tunnel becoming sealed. When the larva is large and the seed is completely devoured, the empty skin generally continues to grow for some time before turning brown and shrinking The presence of a larva within a fruit is always indicated by the conspicuous cylindrical reddish-brown faeces that hang from the entrance to the gallery.

In the field a Chrysopid larva was found preying on a larva of *Deudorix*, and when it was taken to the laboratory it sucked all the fluid from a larva 9 mm. long in 17 minutes. It spun its cocoon on 21st April and the adult emerged 9 days later.

Harrison (C. J.). **The Occurrence and Treatment of Red Spider on Tea in North-east India.**—*Memor. Tocklai exp. Sta. Indian Tea Ass.* no. 2, 26 pp. Calcutta [1938].

The first part of this paper on the infestation of tea in north-eastern India by *Tetranychus bioculatus*, W.-M., consists of a review of the literature dealing with the causes of attack and methods of treatment. In the second part, experiments on control are described. A nicotine spray (1 lb. tobacco in 12 gals. water) or Bordeaux mixture (1 per cent.) applied to young and vigorous tea bushes in Assam in January and March 1930 had no effect on slight attacks of *T. bioculatus* in May–June and early in September. Lime-sulphur (1 part 8°Bé. stock solution in 6 parts water) somewhat lessened the May infestation, but not the later one. Further experiments with lime-sulphur, details of which are given, were carried out in Assam and the Dooars from 1932 to 1937, except in two years when the mite was practically absent. The results were often rendered inconclusive as infestation was slight, but it appeared that spraying just after the first flush would be of considerable value if infestation was severe. The best results were obtained with sprays applied in April ; spraying in December or July had little or no effect. In most cases a strong lime-sulphur (1 part 30°Bé. concentrate in 23 parts water) was superior to a weak one ; it did not affect the crop appreciably even when used in the

flushing season. In one extensive experiment, application in April increased the crop throughout the season (except for 4 weeks after spraying, for which period lime-sulphur almost always reduced it), a total gain of about 10·4 per cent. of the unsprayed crop resulting.

Pruning experiments showed that infestation was heavy when the bushes were only cut across and was progressively lessened by heavier pruning, being almost absent when all new shoots except one on each branch of older wood were removed. Much loss of crop was, however, caused by the latter type of pruning, which, even in a year of heavy infestation, is not justified by total yield. Complete defoliation lessened infestation, but not sufficiently to affect the crop. Tea left unpruned is particularly susceptible to attack. The removal of unproductive growth of the previous season appears to be the most important factor, so far as pruning is concerned, in the control of *T. bioculatus*. In Assam, clean pruned tea, whenever it is pruned, has better total crop than tea cut across, even in normal years ; in years of heavy infestation, the advantage is even greater. In the Dooars, also, clean pruned tea is generally better than tea cut across. Late pruning, while it reduces attack by red-spider, results in more loss of crop (especially early second-flush crop) than early pruning, even in years when infestation by the red spider is severe.

Weedy areas were more infested than clean ones. The application of bulk organic manures appeared to increase, and that of ammonium sulphate to decrease, susceptibility of tea to attack. On a block of young tea planted in 1935, attack was more intense on the dark leaf race than on the light leaf one ; plots that had received more nitrogen were slightly more infested, presumably because of the depressing effect of nitrogen on young tea ; large or small doses of phosphoric acid manure slightly reduced the intensity of attack, and potash manure had no effect. Bad drainage, which causes the bush to be subjected to temporary water starvation in dry weather, thereby increases infestation, which usually follows a dry spring. In general, any measure that increases the vigour and flushing capacity of the bushes reduces their liability to infestation.

Papers noticed by Title only.

Imperial Institute. **Quarterly Bibliographies on Insecticide Materials of Vegetable Origin, Nos. 1–3 (October 1937 to June 1938).**—*Bull. imp. Inst.* **36** nos. 1–3 pp. 123–127, 284–289, 438–444. London, 1938.

Clark (E. P.). **Quassin. III. Picrasmin.**—*J. Amer. chem. Soc.* **60** pp. 1146–1148, 2 refs. Easton, Pa, May 1938. [*Cf. R.A.E.*, A **26** 368.]

Acree, jr. (F.) & LaForge (F. B.). **Constituents of Pyrethrum Flowers. X. Identification of the Fatty Acids combined with Pyrethrolone.**—*J. org. Chem.* **2** no. 4 pp. 308–313, 3 refs. Baltimore, Md., September 1937. [Recd. August 1938.]

Rose (W. G.) & Haller (H. L.). **Constituents of Pyrethrum Flowers. XI. Chrysanthin.**—*J. org. Chem.* **2** no. 5 pp. 484–488, 9 refs. Baltimore, Md., November 1937. [Recd. August 1938.]

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URQUIJO LANDALUZE (P.). **Investigaciones sobre las orugas minadoras del maíz en Galicia** (*Pyrausta nubilalis* **Hbn. y** *Sesamia vuteria* **Stoll).** [Investigations in 1934 on Larvae of *P. nubilalis* and *S. vuteria* boring in Maize in Galicia, Spain.]—*Bol. Pat. veg. Ent. agric.* **8** pp. 87–98, 17 figs. Madrid, 1936–37 [1938]. [*Cf. R.A.E.*, A **24** 83.]

URQUIJO LANDALUZE (P.). **Posibilidades de lucha biológica contra las orugas de la col.** [The Possibilities of Control by Parasites of the Cabbage Caterpillars in Spain.]—*Bol. Pat. veg. Ent. agric.* **8** pp. 171–178, 4 figs. Madrid, 1936–37 [1938]. [*Cf. R.A.E.*, A **24** 84.]

Nonell Comas (J.). **Introducción y difusión del** *Aphelinus mali* **(Hald.) en España.** [A Survey of the distribution in Spain of *A. mali* parasitising *Eriosoma lanigerum*, Hsm.].—*Bol. Pat. veg. Ent. agríc.* **8** pp. 179–186. Madrid, 1936–37 [1938]. [*Cf. R.A.E.*, A **21** 304.]

Schedl (K. E.). **Die Einteilung der Pityophthorinae. (46. Beitrag zur Systematik und Morphologie der Scolytidae und Platypodidae.)** [The Division of the Pityophthorinae. (46th Contribution to the Classification and Morphology of the Scolytids and Platypids.)] —*Arch. Naturg.* N.F. **7** pt. 2 pp. 157–188, 35 figs. Leipzig, 1938.

Tissot (A. N.). **The gross Anatomy of the Digestive and Reproductive Systems of** *Naupactus leucoloma* **Boh.**—*Florida Ent.* **21** no. 2 pp. 20–27, 8 figs., 7 refs. Gainesville, Fla, July 1938.

Luginbill (P.). **Control of Common White Grubs** [*Lachnosterna*] **in Cereal and Forage Crops** [in the United States].—*Fmrs' Bull. U.S. Dep. Agric.* no. 1798, 19 pp., 19 figs. Washington, D.C., April 1938. [*Cf. R.A.E.*, A **11** 324.]

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Indices to Vol. VI–XVI.

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